AN EXPERIMENTAL INVESTIGATION OF RELATIONSHIP BETWEEN TEST ANXIETY AND MEMORY PROCESSES UNDER DIFFERENT MOTIVATIONAL CONDITIONS

By

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Dedicated to,

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The purpose of this experiment was to investigate the hypothesis that provision of differential instructions (low and high stress) will change student's task performance as a function of four measures of anxiety (test anxiety, general anxiety, A-State, and A-Trait).

Following administration of the anxiety tests, ninety-four male and female undergraduates were randomly assigned to low stress or high stress instruction. All Ss received the same task materials consisting of four tasks requiring two distinctly different types of memory processes. Those who received low stress instruction were not under any kind of evaluational situation which could effect their performance, whereas those who received high stress instruction were placed under an evaluational situation.

Multiple regression analysis was used comparing four measures of anxiety and two instructional treatments for four tasks representing two distinct memory processes. Analysis of main effects showed that there were significant relationships between the anxiety measures taken as a set and performance on the tasks. In addition Low Stress Instruction

produced significantly higher performance levels than high stress instructions. Analysis of aptitude treatment interaction showed several interactions. For the low stress instructional treatment the relation between A-State and performance on information conservation tasks (reversal and recalling) was positive, but for the high stress instructional treatment the relation between A-State and performance was negative. On the other hand, for the low stress treatment the relation between test anxiety, general anxiety and trait anxiety and performance on both information reduction and information conservation tasks was negative, but for the high stress instruction test anxiety was unrelated to performance on information reduction tasks. The results did not support the theoretical distinction between the two different types of memory processes. Therefore, it was concluded that further experimental work would be required because of the complicated relationship between performance, task complexity and the effects of anxiety.

CHAPTER I
THE PROBLEM

Statement of the Problem

The purpose of the present study is to determine the relationship between level of text anxiety and provision of differential instructions (low and high stress instruction) on the task performance requiring different memory processes among undergraduate college students, using an Aptitude x Treatment Interaction (ATI) model.

Background to the Problem

Anxiety is generally considered not only a universal emotion, but a mark of man's humanity. Wolman (1973) has pointed out that according to Freud the "ego's" reaction to external threat is called fear. When the ego is exposed to threat from within, that is, coming from the "id" or the "superego," its reaction to such a threat is called anxiety. Later on (1926), Freud presented a new theory of anxiety in which he believed anxiety originates from the infant's inability to master the overflow of excitations. A neonate is usually exposed to more stimulation than he can possibly master. Excessive stimulation may become "traumatic," and hence creates the painful feeling of "primary anxiety." According to Freud (1915):

> The problem of anxiety is a nodal point at which the most various and important questions arise, a riddle whose solution would be bound to throw a flood of light upon our whole mental existence.

According to Sullivan, H. S. (Wollman, 1973), anxiety results whenever the biological needs of an individual can not be satisfied in a "socially acceptable way." The individual develops a feeling of insecurity and uneasiness. It is always connected with an increased muscle tension. Anxiety is a socially produced muscular tension which interferes with other tensions or "normal mental functioning." The relief of this socially created tension brings the pleasant feeling of "self-esteem," the antithesis of anxiety.

Skinner, B. F. (Wollman, 1973) views anxiety as the result of the conditioning. It is the response to a neutral stimulus which has been associated with an "aversive stimulus." To Skinner anxiety is not an inner state but a group of emotional tendencies which are elicited by a specific situation.

In contemporary life the significance of anxiety has been adapted by writers such as Camus (1947) reflecting to this period as "the century of fear", and by Auden (1947) "the age of anxiety." In music Leonard Bernstein's second symphony (1960) as well as a modern ballet by Jerome Robbins also is titled "the age of anxiety" (Mason, 1954). Perhaps the personality characteristic most studied in recent years has been anxiety as defined by scores on tests like the Taylor Anxiety Scale (Sarason, 1957a). Sarason argues that people are not anxious every minute of the day and that often we can specify the conditions which will lead to an increase in anxiety in the individual. He believes perhaps what we need is not general anxiety scale oriented toward the kind of anxiety responses (e.g., sweating, awareness of an increase in tension, etc.) which an individual will admit to but, rather, tests

designed to assess the specific conditions under which anxiety is aroused or, perhaps some combination of both. One of these specific conditions which has been investiated a great deal recently, has been based on a true-false questionnaire which is specifically concerned with the subjects' attitudes and experience in a testing situation. Thus, there is a suggestion (Sarason, 1957a) that different anxiety scale, e.g., test and general anxiety questionnaires, may lead to different kinds of relationships in certain kinds of situations. It may well be that the more specific the anxiety scale is to situations which are similar to the experimental situation, the more will the measure of anxiety be related to performance.

Related Theory and Research

One of the most stimulating and provocative developments in the study of anxiety according to Saltz and Hoehn (1957) has been the attempt by Taylor and Spence to relate a clinically oriented definition of anxiety to modern behavior theory. The writers suggested that because of the potential significance of this development, it is important that Taylor-Spence theory be rigorously tested. Taylor (1951) originally conceptualized manifest anxiety as a drive variable. Taylor proposed the hypothesis that (a) the total effective drive strength (D) of a subject was, in part, a function of the level of "internal anxiety" or "emotionality" of the subject, and (b) the level of this internal emotional state would, in turn, be reflected by the response made in a test of so called manifest anxiety (Taylor and Spence, 1952). Her theory followed the conventional Hullian notion of response strength

as a multiplicative function of a learning factor and a drive factor (Saltz and Hoehn, 1957). Since an anxious subject was theorized as operating at a higher drive level than nonanxious subjects, the prediction according to this theory was that anxious subjects would learn faster than would less anxious subjects. This theory worked well in simple conditioning experiments, anxiety was found to facilitate the acquisition of eyelid responses (Taylor, 1951). The theory proved inadequate, however, for more complex verbal learning (Saltz and Hoehn, 1957). Montague (1953) appears to have been the first to use the Taylor Scale in verbal learning study. In his report (1951) he indicated that anxious subjects performed less well than nonanxious subjects on difficult tasks with many incorrect tendencies, showed greater improvement of performance as the task became easier, and surpassed nonanxious subjects on the task with the least number of incorrect tendencies. As a consequence of Montague's study, Taylor and Spence (1952) elaborated upon the earlier theory. The revised Taylor (1956) and Spence (1958) theory holds that, the effect of anxiety or drive level on performance in a learning task depends upon the relative strength of the correct and competing response tendencies that are evoked by the task. On simple tasks in which correct response tendencies are stronger than competing response, high drive facilitates performance; on complex or difficult tasks in which competing response tendencies are stronger than correct response, high drive interfers with performance.

Based on "drive state" and the resultant responses in the test situation, these drives have been considered as falling into two main categories (Mandler and Sarason, 1952):

1. Learned drives which are a function of the nature of the task, test materials, and instructions. These drives consist of the need to achieve and to finish the task; in other words, drives which evoke responses relative to satisfying the requirement set by the task, which has been referred to as task drives (S_T). It has been assumed that these drives are reduced by task responses (R_T) which lead to completion of the task.

2. A learned anxiety drive which is a function of anxiety reactions previously learned as responses to stimuli present in the testing situation. Anxiety is here considered as a response-produced strong stimulus with the functional characteristics of drives as discussed by Miller and Dollard (1941). Anxiety reactions are generalized from previous experiences to testing situations. The anxiety drive (S_A) primarily elicits responses that tend to reduce the drive. According to Mandler and Sarason (1952) these responses are considered to be of two general types: (a) Anxiety responses which are not specifically connected with the nature of the task or materials. These responses (R_A) may be manifested as feelings of inadequacy, helplessness, heightened, somatic reaction, anticipation of punishment or loss of status and esteem, and implicit attempts at leaving the test situation. Therefore it can be said that these responses are self rather than task centered. (b) Anxiety responses which are directly related to the completion of the task and which reduce anxiety by leading to completion of the task. These responses (R_{AT}) are functionally equivalent to R_T responses.

The R_T type responses and R_{AT} lead to task completion, while R_A type responses interferes with task completion.

It is assumed that (Mandler and Sarason, 1952) R_{AT} responses which are considered to be specific to the task, are not available in response repertory of an individual, but are evoked and learned in the course of task performance; R_A responses, which are not considered to be specific to the task, are available in the response repertory and are, by the process of generalization readily evoked. Therefore, individuals with the high anxiety drive and a large number of R_A (anxiety responses) in their response repertory will tend to make more R_A responses initially than individuals with a low anxiety drive and conversely, in relation to the total number of responses available, individuals with a low anxiety drive will tend to make more task relevant anxiety responses (R_{AT}) than those with a high anxiety drive. Therefore, based on Hullian drive-theory the prediction will be that high anxious subjects are superior to low anxious subjects on relatively easy tasks, but the reverse holds on more difficult tasks.

Test Anxiety Scale and General Anxiety Scale

Recently, an increasing amount of research has been devoted to the development of measures of test anxiety. According to Allen (1970) most test anxiety scales have been rationally, rather than empiricially derived from an interpretation of anxiety best summarized by Sarason (1960). The theory states that high test anxious subjects should emit more task-irrelevant responses than low test anxious subjects in situations perceived as threatening, but no differences in the frequency of such responses will occur in situations perceived as non-threatening. The most widely used test anxiety scale, the Test Anxiety

Questionnaire (Mandler and Sarason, 1952), Test Anxiety Scale (Sarason, 1958), and the Anxiety Achievement (Alpert and Haber, 1960) are based on such a theory of anxiety. These scales are specifically concerned with attitudes and experiences in only a testing situation in which anxiety is aroused rather than general anxiety responses (e.g. sweating, being worried, hard to get to sleep).

Allen (1970) indicates that contradictory findings concerning the correlation of these three scales (Test Anxiety Questionnaire, Test Anxiety Scale, and Anxiety Achievement) may be in part due to the fact that most test anxiety scales indiscriminately measure what Cattell and Scheier (1961) call trait and state anxiety. Both trait and state test anxiety scale measure the frequency and magnitude of subjects responses to situations associated with anxiety. The types differ in that trait scale is thought to be less prone to momentary situational influences than state scale. However, this distinction is not believed to be empirically stable (Allen, 1970).

The General Anxiety Scale purports to tap the extent to which the individual experiences anxiety in a variety of situations other than testing. According to Sarason (1958a) the statements used on this scale include some items found in the MMPI, the Taylor Anxiety Scale, and Sarason's General Anxiety Questionnaire.

In this study a major interest in in the Test Anxiety Scale. This scale originated from Mandler and Sarason's (1952) Test Anxiety Questionnaire. These investigators studied stress in academic evaluative and achievement situations. As it was mentioned previously this questionnaire was specifically concerned with the subjects attitudes and

experience in the testing situation (Mandler and Sarason, 1952). The questionnaire consisted of 67 questions and was divided into four sections: (a) individual intelligence tests, (b) group intelligence tests, (c) course examinations, (d) general questions. Each section contained anxiety questions dealing with the Ss subjective experiences in the testing situation such as "uneasiness," "accelerated heart beat," "perspiration," "emotional interference," and "worry" before and during a test session. The questionnaire also contained questions relating to attitude (likes and dislikes) towards tests.

The split half reliability (odd vs. even questions) of the anxiety questionnaire by way of Spearman-Brown Prophecy estimate was .91 (Mandler and Sarason, 1952).

Survey of Literature on Test Anxiety

Over the years much research on test anxiety has been on the correlation between test anxiety and performance on different types of tasks. For example test anxiety has been found to have an adverse effect on verbal and motor learning, stimulus generalization, form discrimination, and size estimation (Sarason, 1969; Sarason and Smith, 1971; Wachtel, 1968). Also it has been found that test anxiety relates to academic failure among college students (Spielberger, 1962). Is this because high test anxious subjects are less bright or less alert, or are they more affected by stress than those low test-anxious in the test anxiety score distribution? Experimental studies show that many highly test anxious persons are not deficient in intellect, rather those people exaggerate and personalize inordinately the threat of evaluation

that may affect their performance (Sarason, 1961; Mandler and Sarason, 1952; Sarason, 1956, 1957; Watson and Friend, 1969).

Two other empirical findings (Sarason, 1960; Sarason, 1961) suggest that the difference in performance between Test-Anxiety Scale (TAS) neutral and high TAS achievement-oriented groups is not due to the factor of intelligence, but rather to differences between the experimental and control instruction.

Some of the investigators have viewed test anxiety as a proneness to emit self-center, interfering responses when in situations such as evaluations (Liebert and Morris, 1967; Mandler and Sarason, 1952; Sarason, 1960). This S-R interpretation also has been studied in terms of autonomic reactivity such as sweating, increased heart rate, etc. (Berry and Martin, 1957; Raphelson, 1957), and in terms of cognitive events, such as when a subject who is taking an entrance examination says to himself: "I am stupid, maybe I won't pass." (Doctor and Altman, 1968; Pharges, 1968; Spiegler et al., 1968). The time interval between administration of the threat and the actual occurrence may itself be a significant variable (Sarason and Ganzer, 1970). Task complexity has been shown to decrease performance among those who are anxious (Sarason, 1960; Ruebush, 1963).

It has been reported that audience and group coaction are factors reducing performance of high test anxious individuals (Ganzer, 1968; Pederson, 1970).

Another dimension of research which deals with test anxious scorers concerns the meanings they attach to performance cues. For example what are the subjects told about the task on which they perform?

With regard to instructions given how important are the tasks made to seem? For example instructions given to subjects are considered as "standard instruction" or "reassurance instructions?" (Sarason, 1958b).

The kind of thought test anxious individuals and non-test anxious individuals engage in is described by Mandler and Sarason (1952) as follows:

> The high anxious subject tells himself that the appropriate (not necessary useful or adaptive) behavior in a test situation consists of observing his own behavior, of examining his failures, of ruminating aobut his response and his emotional reactions, of thinking about standards set by himself or by the performance of others.

In contrast of high test anxious, the low test anxious subject gives himself few such instructions and may instead orient his behavior and cognitions toward the specific requirements of the task, excluding extraneous ideations, but trying to analyze appropriate task oriented behavior (Mandler and Sarason, 1952). According to Mandler by assuming that the kind of self-instruciton a high test anxious subject gives himself is self-deprecating, interfering, and failure-inducing, we must see under what conditions these self instructions are operative? The type of instructions the test anxious individual gives himself before the actual performance occurs is likely to be: "This is a task in which I will do badly," "This is a task in which I will have difficulty," or "This is a task in which I am going to be upset," and so forth. As soon as these subjects then find themselves in a test situation these self instructions are let loose and interfere with performance under certain conditions (Mandler and Sarason, 1952).

The self instruction or attention of the high test anxious subject, considering that he is strongly self-depreciative and ruminative, was

examined. The evidence shows that the highly test anxious individual plunges toward himself in comparison to the less test anxious person who plunges into a task when he thinks he is being evaluated. High test anxious persons either neglect or misinterpret information cues that may be readily available, or experience attentional blocks (Doris and Sarason, 1955; Sarason and Ganzer, 1962; Sarason and Koening, 1965).

It is well documented that the effect of test anxiety can be reduced by many procedures, such as reassurance, (Sarason, 1958b) in which the subject is told, in effect, not to worry about his level of performance. The results show under conditions of reassurance, the high test anxious subjects are superior to low test anxious subjects. Therefore, reassurance of subjects provides instruction at variance with the self-instructions; however, the reassurance instructions have the opposite effect for the low test anxious subjects. The reassurance condition for low test anxious subjects functions to reduce their "ego envolvement" (Sarason, 1958) in the task in which they are performing. If the subject is told that error inevitably occurs, one conclusion which some subjects might have drawn is that effects at reducing errors will be of little value (Sarason, 1958).

Another procedure which has been used in order to reduce the effect of test anxiety among high test anxious subjects is observation of a model. In one study (Sarason et al., 1968) high and low test anxious college students made use of opportunity to observe someone else perform a task similar to one which they will later perform. They found that the performance of high test anxious students increased more as a function of opportunity to observe a model than did low test anxious students.

In terms of the effect of observing someone else failing on a task (Sarason, 1959), even a different task, the evidence shows that it has a similar effect on high test anxious college students. In contrast to high test anxious subjects, observing failing in another person seemed to have the opposite effect on low test anxious college students. Among the reasons that Sarason gives for this opposite effect for low test anxious students, is that observing the failure of another person may have "heightened attention, motivation, and effort."

The influence of preperformance information has different effects on high and low test anxious scorers (Whalen, 1969; Marlatt et al., 1970; Sarason, 1972). If preperformance instructions are based on an evaluative or achievement-orientation, it has been shown that high test anxious scorers tend to perform at a low level on complex tasks compared with a control group. However, the same preperformance information seems to have a "salutary" effect on low test anxious subjects, in comparison with the control group.

Test anxiety deals with a real problem which exists among students. It is manageable because it is susceptible to manipulation and study in laboratory situations. During recent years, diverse methods of behavior modification, psychotherapy and counseling, reinforcement, desensitization, implosion, and modeling have been explored in relation to test anxiety (Johnson and Sechrest, 1968; Cohen, 1969; Donner and Guerney, 1969; Ihli and Garlington, 1969; Mann and Rosenthal, 1969; Mitchell and Ingham, 1970).

An experimental study which can be considered as a bridge between the study of personality and clinical psychology is found in the study

by Wine (1970). Her assumption was that when highly test anxious subjects perform poorly it is because they are not paying adequate attention. One of the treatment conditions involved giving subjects an intensive six-hour training program in which they worked on tasks under instruction to attend to the task and not to themselves. In addition, subjects observed a videotaped model displaying productive attentional treatment toward the task which reduced their test anxiety. The attentional treatment increased their levels of performance on several different tasks. Wine (1971) considered the harvest of test anxiety to contain two products, in the cognitive sphere, the existence of self-perceptions, expectation and fear, in the autonomic sphere the existence of high physiological reactivity, although there are significant individual differences in the acquisition and level of cognitive and autonomic responses.

Spielberger (1972) discusses the nature of anxiety as a transitory emotional state (A-State) which consists of feelings of apprehension and tension, and heightened activity of the autonomic nervous system. It is assumed that A-State varies in intensity and fluctuates over time as a function of the stresses that impinges upon the individual. According to Spielberger (1972) if an individual reports that he feels anxious (frightened or apprehensive), this introspective verbal report defines an anxiety state. The use of introspective report in the measurement of the anxiety state assumes, of course, that "people are capable of distinguishing between different feeling-state, and that they are motivated to report accurately and honestly." Spielberger points out that in order to establish the construct validity of measures of A-State based on

introspective verbal reports, experimental procedures must be employed to determine the relationship between these self-report measures and physiological and behavioral indicants of anxiety. State anxiety (A-State) refers to the complex emotional reactions that are evoked in individuals who interpret specific situations as personally threatening (Spielberger, 1972). If a person perceives a situation as threatening, irrespective of the presence of real (objective) danger, it is assumed (Spielberger) that he will respond to it with an elevation in A-State, i.e., he will experience an immediate increase in the intensity of an emotional state characterized by feelings of tension and apprehension, and by heightened autonomic nervous system activity. The intensity and duration of this A-State reaction will be determined by the amount of threat that is perceived, and by the persistence of the individual's interpretation of the situation as dangerous. Thus A-State like test anxiety is considered to be a measure of anxiety in a specific situation rather than a measure of general anxiety or A-Trait. Persons who are high in A-Trait according to Spielberger (1972) tend to perceive a large number of situations as dangerous or threatening than persons who are low in A-Trait, and to respond to threatening situations with A-State elevations of greater intensity. In other words, state anxiety is distinguished from anxiety proneness or trait anxiety (A-Trait), in that A-Trait refers to individual differences in the frequency that anxiety states are manifested over time.

By reviewing the existing literature on anxiety it has appeared that previous research on anxiety has given little attention to the effect of anxiety specifically on cognitive processes. It seems that

until we have information about the specific cognitive processes affected by anxiety the only strategy to help the high anxious person is to reduce his or her anxiety. When such information is available we may then design learning situations which utilize the advantages and avoid the disadvantages of anxiety such as studies reported by Sieber (1969) and Leherissy et al. (1971).

Sieber et al. (1969) gave subjects who showed different amounts of anxiety certain chess-like problems to solve. They hypothesized that the debilitating effect of anxiety on problem solving was due to its effect on short-term memory. Two treatments were designed: regular problem solving and problem solving with visual memory supports. The treatment providing memory support was expected to primarily benefit anxious subjects. This expectation was supported, and this finding has been replicated in a number of studies by others (Leherissey et al., 1971). In their study memory support was found to reduce the errors made by high A-State students, that is high A-State in memory support condition made fewer errors than high A-State students in a non-memory support condition, where as "medium" and "low" A-State students performed equally as well with or without memory support. Therefore, the significand interaction between level of A-State and memory conditions is consistent with that of previous memory support studies by Sieber et al. (1969). However, Leherissey et al. (1971) suggested that it may not be memory support per se that reduces the undesirable effects of anxiety on performance, but the type of memory support provided in the primary importance. The data reported seem to indicate that providing high A-State students with their previous incorrect responses does facilitate

performance, it also leads to an increase in levels of state anxiety for students in the memory support condition.

In another study (O'Neil, 1972) it was shown that negative feedback about performance in the stress condition led to greater initial increments in A-State for high A-State subjects. In contrast, the high A-Trait and low A-Trait subjects in the nonstress condition who were given nonevaluative information about their performance showed parallel changes in A-State. The final conclusion was that, only when stress was produced through negative evaluations of performance did the high A-Trait subjects show greater initial increments in A-State than the low A-Trait subjects.

Most of the previous and current studies regarding anxiety deal with these two different types of anxiety: anxiety as a trait, and anxiety as a transitory process variable. As it was mentioned previously trait anxiety is the relation between individual's degree of anxiousness and their connecting characteristics such as feelings of apprehension and tension. Trait anxiety refers to relatively stable individual differences in anxiety proneness, and is manifested in certain effective responses in which most of them have debilitating effect on intellectual performance (Spielberger, 1972). On the other hand, anxiety as process variable or transitory state deals with the mutual relationship between anxiety-cognitive process variables and overall task performance. It is assumed that each variable may affect any other variable (Sieber, 1969). Sieber suggests that the analysis of the effect of anxiety on cognitive processes with respect to process variables entails construction of a model of the processes which are required for performance in a given

set of tasks. The kind of cognitive processes required for the adequate performance depends on the given tasks. Some of the cognitive processes Sieber (1969) mentioned are such variables as short term memory, ideational fluency, ability to evaluate own progress, and attention.

Therefore, it seems additional research on the relationship between anxiety and perceptual and problem solving processes that influence both how information is utilized and interpreted, as well as the effect of the information processing behavior, are needed to fill gaps in knowledge that exist at the present time.

Overview of Related Research on Memory

One of the most common observations made about behavior of organisms, at all points along the evolutionary ladder, is their consistency under similar conditions. Organisms either inherit or develop characteristic modes of thinking, adapting, or responding. Such modes or adaptive orientations not only differ among species but are observed as individual differences within species, and change in the same organism as a result of change in environmental conditions.

The famous psychologists William James once said that "to remember is to think about something which we previously experienced, and which we were not thinking about immediately before" (James, 1890). Although James' definition was intuitive appeal; still, the concept of memory is not readily captured in a single phrase. Human memory is often studied under the labels "cognitive psychology" and "the information processing approach" within psychology. A comparison of cognitive approach to an older, and still viable, approach to the study

of memory it seems would be helpful at this point. This older approach is that of stimulus response(S-R) theory, or associationism. According to the S-R approach, the ability to remember depends on the information of associations, or bonds, between stimuli and responses. The strength of those bonds, called habit strength, determines the ability to remember. If a particular bond is sufficiently strong it can be said to represent memory. Therefore, the nature of memory according to S-R theory or associationism depends on the stimuli and responses involved. Associationists argue that the S-R theory can also account for more subtle and complex human behavior. One way in which this is accomplished is by assuming that there are internal stimuli and responses. In essence, what this means is that there are stimuli and responses that are not directly observable. These covert responses may serve as stimuli for other responses, and in this manner, unobserved S-R chains could come to exist. By this means, more complex mental events can be brought into the frame work of S-R theory.

However, there are problems with the associationist approach. For one thing, the associationists focus on the contingencies between stimuli and responses and the principles of conditioning which describe how associations are formed and how habit strength can be manipulated. They have little to say aobut the events that intervene between stimulus and response (Melton, 1967). An expanded version of McGuire model is presented by Melton (Fig. 1) which is a blend of S-R and information processing constructs.

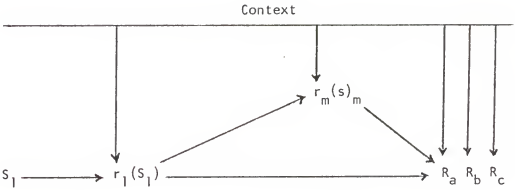

Figure 1. Melton's Multi-Process Model of Associative Learning.

Where:

S_1 = Physical stimuli.

r_1 = Coding response to physical stimulus, S_1. Also it is called stimulus differentiation component.

(S_1) = Internal representation of physical stimulus.

$r_m(S_m)$ = Alternative mediation route. It may also represent a recoding response to physical stimuli.

R_a, R_b, R_c = Required response or response integration component.

As Melton points out (in Gagne, 1967):

> The basic notion in this model is that all paired-associate learning and perhaps all learning, involves a stimulus differentiation component, a response integration (and perhaps differentiation) component, and a "hookup" between the internal representation of the integrated response or a segment of it.

On the other hand, the cognitive approach to memory has a considerably different emphasis from the associationist approach. The word cognitive, which is derived from cognition, meaning knowledge, emphasis mental activities, not just stimuli and responses. It is precisely this

shift to emphasize away from a passive system that accepts stimuli and automatically produces S-R chains, and toward a notion of mental action that characterizes cognitive theories. According to Neisser (1967), whose book, "cognitive psychology" gave real impetus to the approach, the focus of cognitive theory is knowledge; how it is acquired, modified, manipulated, used, stored, how it is processed by the human organism.

Thus, information processing (a term cognitive psychologists have borrowed from computer scientists) broadly refers to the human being's active interaction with information about his world (Ruben and Kim, 1975). Of central importance in this processing are the mental activities that occur between a stimulus and a response.

Current information processing models typically specify one or more parameters representing particular processing steps. These variables typically represent the speed, efficiency or capacity of operations in particular step (Koran, 1975).

According to Hunt (1975) there are five basic postulates of the theoretical approach toward information processing, they are:

1. Information storage is a process of recoding into progressively more complex, meaningful units. This process may vary with respect to individual differences in how that information will be stored and how it can be accessed later.

2. The process of recoding requires that the activity of storing information in different periods of time. The information in short term memory in an encoded form is often referred to as a memory "code."

3. It is possible to alter the code in short term memory.

4. The long term memory (LTM) is a permanent information storage system of codes which can not be modified.

5. The code change in Short Term Memory depends upon a pattern recognition mechanism in which Short Term Memory is recognized as being in a state appropriate for the application of a transformation stored in Long Term Memory. For example, the pattern "A" may be replaced by the acoutic code -A-. At the deeper level, "3+2" can be recoded as "5," and so on for more complex types of information transformation.

In this study the author attempted to examine some high level task performances in terms of memory functions and individual differences.

<u>Related Research to Memory</u>

In discussing human memory one of the experimental procedures which have been used for many years is called "List-Learning Procedures" (Klatzky, 1975). In this procedure the subject (the person in the experiment) learns a list of items. The items might be single words, pairs of words, or "nonsense syllables." (Nonsense syllables are also called CVCs, for Consonant-Vowel-Consonant, which is the form they take such as DAX, LOC). The learning of the list occurs over a series of trials. Each trial consists of a presentation of the items to the subject and a test to see what has been learned.

Herman Ebbinghaus was the first person to study learning and forgetting of the list-learning procedure in a systematic way (Wolman, 1973). In fact, it was Ebbinghaus who invented the syllables, he did so because he wished to eliminate what he considered an undesirable experimental factor-meaning. As Klastsky describes (1975):

> Ebbinghaus constructed lists of nonsense syllables that he presented to himself at a constant rate. He read the list until he thought he knew them, in some cases, well after he could recall them perfectly. Later, he tested himself again on the lists. His measure of how much had been retained in memory was a measure of "saving," that is, how much work was needed to relearn the lists after a given amount of time had elapsed. The amount of savings indicated how much of what was learned had been saved.

Among many contributions which Ebbinghaus made to the study of memory one important discovery was that if a list was short enough--say, seven or less items--he could learn it in just one reading. If the list increased to eight or more items, the learning time increased dramatically. In fact, there was a discontinuity at around seven items; below it, there was immediate learning; above it, learning took several trials--the number of trials increased with the number of items. The seven-item limit is referred to as immediate memory span (Klastsky, 1975).

Retention Interval (the time between initial learning and later testing) was another major discovery by Ebbinghaus. In other words, the amount of information forgotten will increase as time passes. The course of forgetting is illustrated in Figure 2.

Therefore, it is very rapid forgetting over the first few minutes (the amount of saving decreases rapidly), but gradually the rate of forgetting decreases (the amount of savings decreases more slowly).

Ebbinghaus' original list learning procedure was similar to what is today called "Serial Learning." Serial learning is characterized by the fact that the subject must learn the list of items in a given order. This type of experiment has revealed a special learning

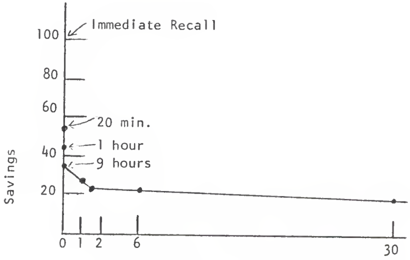

Figure 2 Retention Interval (Days)

Ebbinghaus's forgetting function. Retension of previously learned lists of nonsense syllables, as measured by savings, is plotted as function of the retention interval-the time between initial and the retention test.
(After Ebbinghaus 1885-Klatzky, 1975-).

phenomenon known as the "Serial Position Effect," that is, the rate of mastering items in a series are different. The number of errors is greater for items in the middle of the lists than for items at either of the ends, and this is true for lists of any length beyond the memory span (Smith and Smith, 1966). Or as Miller (1956) would say:

> There is a clear and definite limit to the accuracy with which we can identify absolutely the magnitude of a unidimentional stimulus variable. I would propose to call this limit the "span of absolute judgment," and I maintain that for unidimentional judgments this span is usually some where in the neighborhood of seven.

A second procedure which has been used very often in memory experiment is "paired-associate learning" which is characterized by the fact that each item is really a compound; that is, it has two parts. For example, a word and a number.

A third experimental procedure which has been used in memory research is that of free recall. In free recall, unlike serial recall, the subject is free to report the items in any order he or she chooses.

And finally, the experimental procedure in memory research is that of recognition testing. The recognition paradigm is characterized by the fact that the subject sees the list of items when he is tested instead of having to recall them.

The human being is more susceptible to loss of information comparing with a standard computing system. But the laws governing such loss of information are not fully understood (Posner and Rossman, 1965). Therefore, it is important for the study of information-processing characteristics of the human to investigate the interaction of the immediate memory and transformation. There are two crucial factors

about any event, from the point of view of memory, which intervenes between a stimulus and its recall. Similarity of the interpolated event to material in store has been considered as one factor (McGeoch and Lrion, 1951). And the length of time which the interpolated event interrupts rehearsal of stored information (Brown, 1958).

It was found that many tasks which require transformation of input involved information reduction. Thus, different types of tasks may fall within this general category. However, within relatively restricted task configurations the amount of information reduced appears to be a quantitative predictor of task difficulty. Specifically for a set of simple numerical tasks with the same stimulus input it was found that errors increased and rate of processing decreased as the amount of information reduction required by the task increased (Posner and Rossman, 1965).

According to Posner (1965) there are three types of transformations with respect to relation between input and output information for task performance. 1. Information Conservation tasks in which all of the input information must be preserved i.e. standard reaction time and memory span experiments, 2. Information Creation in which output information must exceed input information such as word association and 3. Information Reduction which requires the subject to produce a subset of the stimulus input, such as addition and classification tasks. Information conservation and information reduction tasks represent two distinctly different memory processes.

In four experiments conducted by Posner and Rossman (1965) results for their first experiment indicated that with number and similarity of

interpolated items held constant, the greater the difficulty of a transform the more forgetting will result from it. The major interest in that experiment was to investigate the effect of number and size of informational transforms upon the amount of retention. In the second and third experiment the major concern was to investigate this possibility by keeping the total interpolated time constant (5 digits presented at the rate of 2/second) but varying the size of the transforms performed in that time (5-, 10-, 20-, and 30 second), results showed that these effects can not be attributed entirely to an increase in the time an item remains in storage; rather time in storage and difficulty of transformation both contribute to determining the amount of forgetting. The major concern on the fourth experiment was that the size of the transformation be held constant (all Ss performed the 2 bit classification task) but its location within the series varied (i.e. last pair, third pair, second pair, and first pair). Results on their fourth experiment showed that the loss of material in store is a decreasing function of its distance prior to the transform, but that the transformed material itself, showed no decline in retention. Posner and Rossman's (1965) conclusion was that these obtained results point to an operational definition of "rehearsal" as a process requiring part of the limited central capacity of individual. According to Posner (1965) few experiments, even among those utilizing "memory tasks" require human subjects to operate in the pure retention mode, rather than requiring the subject to use his past experience and his knowledge about the type of response he will have to make in order to reduce his storage load. When the experimenter is interested in the pure retention mode,

he does everything to prevent the processes but conserve the input information. Ordered recall represents the pure retention end of a memorial dimension. This dimension according to Posner reflects the degree to which stimulus information must be conserved in the response (Information Conservation). As one moves away from ordered recall the subject is allowed to represent rather than reproduce the input in the output (Information Reduction). Therefore, memory is not unitary but that there are multiple separate modes of memory processes. Most tasks involve a combination of memory processes requiring Ss to store the incoming stimuli and to reproduce them latter (Posner, 1965). Reading a book, listening to a lecture, forming a concept or solving a problem are examples of complex tasks which involve multiple modes of processing. Each of these tasks requires the subject to take in information, to transform it in various ways in terms of selection, classification, and combination, and to store the product of these operations. The amount of recall or in other words, the rate of forgetting depends not so much on what material (information) occurs after an item, but on how much processing the subject must do with that material (Posner, 1965).

While investigators have begun to explore the relationship between different types of anxiety and memory, this study extends this area by examining the relationship between different types of anxiety and different memory processes. Previous studies examined the relationship between anxiety and memory (Seiber et al., 1969; Leherissey et al., 1971) have failed to distinguish between the various types of memory processes.

Memory seems to be the end-product of a series of very complicated dynamic processes that allow a man to record, preserve, and make use of, within the nervous system, the experience he has undergone, especially those that have been repeated. Like an organism or a society, the memory of man is a living system, which is born and maintained, develops, and dies (Barbizet, 1970). According to Barbizet (1970) memory resembles an army, which recruits and distributes its men, and trains them with repeated exercises, to preserve a coherence at all order that will enable it at any moment to conduct its actions. Memory collects, organizes, preserves, and uses information for its own operations, which make up our gestures, verbal activities, decisions--that is, our general behavior. Like an army again, it depends on its environment, and on the society in which the person develops, for the material that it organizes in its own specific and individual way. It has its successes, difficulties, and its failures. It is the failure of memory, since we take its successes for granted, that lead us to inquire into the workings of the componnet parts of its system and that reveal the complexity of its organization (Barbizet, 1970).

Our knowledge and experience are acquired and accumulated steadily from earliest infancy. A study of circumstances of these acquisitions, and of their similarities and differences from one person to another, should take into consideration the manifold relational and cultural factors that combine simultaneously to produce the individuality of each person.

In considering the application of information transformation consideration with respect to individual differences, Hunt (1975) has pointed

out that information processing involves more than a capacity, it involves a strategy and strategies can be learned. If we do a careful analysis of subject's information processing capacities, then we will be able to develop a training program in which we improve memory functions and design instructional treatments which minimize memory dysfunction.

It seems that one kind of useful research is the investigation of the subject's amount of recall as it relates to the use of different instructional strategies and how these instructional strategies relate to the anxiety level of the subject. It might be that the subject has not been exposed to proper instruction or even environment that allows more transformation of input and less error. The anxiety a subject possess might inhibit or enhance more transformation of information through instruction or environment. Therefore, we are entering the new domain of research namely "Aptitude Treatment Interaction."

Description of Variables for Aptitude x Treatment Interaction Studies Theory of Aptitude x Treatment Interaction Research

A continuous problem related to the development of effective instruction has been adapting the most effective methods for training large numbers of individuals possessing dissimilar patterns of aptitudes. An aptitude, in this context, is a complex of personal characteristics that account for an individual's end state after a particular educational treatment, i.e., that determines what he learns, how much he learns, or how rapidly he learns (Cronbach, 1967).

Cronbach (1957) proposed that the experimental and the correlational school of research should combine and bring forth a Study of Aptitude x Treatment Interaction (ATI).

The notion of aptitude treatment interaction is not a new thought in the scientific world. In Darwin's view for example, natural selection is based on what kinds of environmental conditions favor particular characteristics of species or subspecies. If the environmental conditions change, a different kind of organism is favored, and a concept of a single rank ordering applied either to organisms or environments ignores the fundamental principle that it is the interaction between the characteristics of the organism and the demands of the environment that determines survival or elimination (Koran, 1973). The basic assumption in ATI is that there is no one best educational environment suited to some general, average individual, but that different individuals progress in different educational environments suited for their own characteristics and needs (Koran, 1973).

One of the major benefits of ATI research is to improve instruction. Those being involved in ATI research differ from those involved in traditional research on instruction in that ATI researchers recognize the role of individual differences in learning and attempt to take them into consideration. The importance of this view has been emphasized by Cronbach (1967).

The typical ATI study has at least one measure of aptitude and two instructional treatments. The measure of outcome is regressed on to an aptitude score recorded prior to treatment. The presence of interaction is indicated by non-parallel regression lines of aptitude and treatment. If the regression lines in the treatments differ significantly in slope, there is an evidence of Aptitude x Treatment Interaction (Cronbach, 1957).

Interaction may be either ordinal or disordinal in nature (Cronbach and Snow, 1969). The basic characteristic of a disordinal interaction is one in which the regression lines intersect with the range of aptitudes being considered (Figure 3). The presence of disordinal aptitude-treatment interaction implies that differential assignment of subjects on opposite sides of the interaction to alternative treatments is appropriate for maximizing learning outcome (Koran, 1973). On the other hand, in an ordinal interaction the regression lines have significantly different slopes, but one is superior to the other throughout the range of aptitudes being considered (Figure 4).

An ordinal interaction is practically useful, however, in cases where time, cost, or other reasons limit the number of persons to whom the preferred treatment may be given (Koran, 1973). According to Koran (1973), an ordinal interaction may imply disordinal interaction given a different range of subjects or further manipulation of an experimental variable, although such prediction requires empirical confirmation.

The term aptitude in ATI research has been defined as any characteristic of the person that affects his response to the treatment. This definition allows such variables as task-specific knowledge and skills, cognitive styles, personality characteristics, and heuristic strategies to be considered as well as the more traditional cognitive ability variable (Koran. 1973).

Treatment has been broadly defined for the purpose of ATI research to include variation in structure, pacing, style, or modality of instruction, although eventually this definition should be expanded to

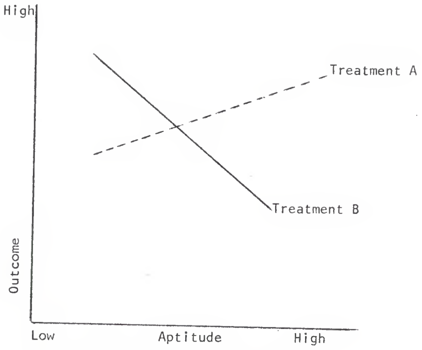

Figure 3. Disordinal Interaction

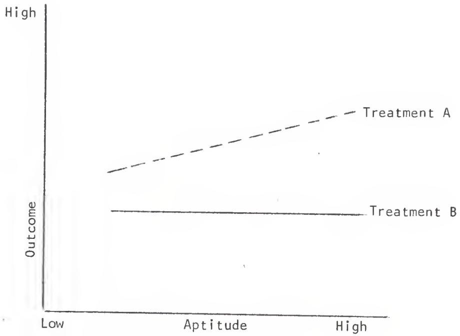

Figure 4. Ordinal Interaction

include non-instructional situations as well (Cronbach and Snow, 1969). According to Cronbach and Snow (1969), treatments should be differentiated in such a way to maximize their interactions with aptitude variables.

Therefore, matching instructional strategies or materials to selected learner characteristics are the general objective of ATI research. Whenever one treatment if not best for all, treatment should be differentiated in such a way to maximize their interactions with aptitude variables (Cronbach, 1975). Although a considerable number of studies in aptitude-treatment interaction have provided initial evidence to suggest that subjects may learn more easily from one method of instruction than other yet, ATI research has still proceeded on a largely trial and error basis (Salomon, 1972).

If the study of ATI is to progress, a theoretical bases for generating meaningful ATI hypothesis will have to be developed. The need for more conceptualization, to reduce the very high "degree of empiricism" prevailing in research, is generally acknowledged (Salomon, 1972).

There have been three heuristic models proposed for the generation of hypotheses in ATI research (Salomon, 1972). The first one of three models which is also the most commonly practiced one is called the "remedial" model. The basic assumption in this model is that some important ingredient of knowledge is deficient or missing, and no progress in learning can be expected unless the deficiency is overcome. Therefore, some kind of remedial instruction is called for to overcome the deficiency. Underlying this model of treatment is a sequential conception of knowledge, of learning, and also instruction. This model is closely related with the work of Gagne. Concepts of more general

ability have little or no place in the remedial model, and Gagné (1970) points out that his model does not attempt to deal with non-cognitive aspects of behavior. Because of the basic assumption of this model, it would be most appropriate for subject matter in which there is an obvious hierarchy of skills, and task-specific achievement comprises a large proportion of variance in learning outcome. Therefore, those subjects lacking specific-skills will benefit from this model. On the other hand, the pay-off function, in terms of cost and energy, is reduced when unnecessary remedies are provided for those who already possess them. In addition there are factors of boredom, reduced motivation, and interference which become critical when remediation is unnecessary.

The second heuristic model for the generation of aptitude-treatment interaction is "compensatory" model. The basic assumption in this model is to provide through the instructional treatment that which the learner can not provide for himself, thereby compensating for learner deficiencies. The difference between the remedial model and compensatory model is that in the remedial model one tries to fill in gaps within the lines of task specific knowledge or specific performance but in the compensatory model the deficiencies are actually left untouched, and only their debilitating effect circumvented (Salomon, 1972) by the instructional treatment. In the compensatory model it is not assumed that all relevant capabilities need to be mastered or they can be easily modified. For example, changes in anxiety, memory, general intelligence, and so forth are not necessary instructional objectives although they may correlate highly with learning outcomes.

The third heuristic model is called the preferential model. The fundamental assumption in this model is to capitalize on what the individual is already capable of doing. This treatment makes use of available strong points in the individual's characteristics. It is preferential in the sense that the treatment plays to the learner's preferred style of information-processing strategy (Salomon, 1972). The ATI discussed by Jensen (1969) is based on such a preferential model, in which he suggests Level I learners should be thought along associative lines or instructional techniques that can utilize abilities manifested in rote learning while level II learners should be taught in conceptual ways. One feature Salomon (1972) points out, that clearly distinguishes between all the models mentioned, is that while both the remedial and compensatory models deal mainly with deficiencies, the preferential model deals with well-developed capabilities. Moreover, in the remedial model, aptitude is directly modified whereas in the preferential and compensatory models no attempt is made to directly modify the aptitude. Instead the treatment either capitalizes or compensates for learner preferences or deficiencies.

It must be mentioned that ATI researchers have increasingly recognized the need to examine cognitive processes in a more refined way. Bunderson (1970) for example, has shown that concept learning tasks may be analyzed into two parts: dimension selecting and associative learning. Each part may be further analyzed into processes which imply a requirement for certain reasoning abilities for dimension selection, and certain memory abilities for associative learning. Attempts to define and develop from the concept learning tasks themselves new aptitude

measures similar to inductive reasoning, associative memory, and other processes have indicated that the process tests generally account for a large portion of performance variance than do pre-existing factor tests (Koran, 1973). According to Koran (1973) the measurement of cognitive aptitude in ATI research will be increasingly based on careful analysis of information processing requirements generated by specific learning tasks rather than on the selection of pre-existing tests. This process analysis should not be limited to cognitive abilities, but also personality dimension. Cronbach and Snow (1969) have concluded that the borderline between personality and abilities lead to personality traits and conversely, personality traits lead to aptitudes determining response to instruction. Sieber et al. (1969) and Leherissey et al. (1971), in investigations mentioned previously, indicated the influence of individual differences in cognitive variabels (test anxiety, A-State, A-Trait) on cognitive processes involved in problem solving.

Aptitude x Treatment Interaction Test-Anxiety-Information Processing as ATI Measure: Related Research

Any instructional treatment with an objective calls for a considerable number of information-processing operations. Some (encoding the message, retrieving previously stored information, and so on) are quite common to all treatments. Other operations are less common and can be varied (Salomon, 1972).

Sieber (1969) investigated test anxiety and certain chess-like problem solving. She hypothesized that the debilitating effect of anxiety on problem solving is mediated by memory of intermediate steps. Her findings showed that high anxiety subjects are not good at recalling

the intermediate steps they take and therefore they repeat their errors. She designed two treatments: regular problem solving and problem solving with visual memory support. The result showed an interaction between treatment and anxiety in which providing memory support for highly test anxious subjects (able to see their previous error) improved their level of performance. Sieber (1969) suggested that high-anxious persons would benefit from learning to use a variety of external aids such as diagrams, outlining systems, and so forth for organizing general ideas prior to the development of complex-related inforamtion.

Leherissey et al. (1971) conducted an experiment to test the hypothesis that memory support reduces State anxiety and errors in a complex computer-assisted learning task among sixty male undergraduate students. It was predicted that high anxiety-state students given memory support would make fewer errors than high anxiety-state students who did not receive memory support. Their treatment procedure was similar to what Sieber (1969) designed in this manner that, the memory support group was allowed to see their previous incorrect responses to each problem before attempting it again, on the other hand this information was not available to non-memory support group. Although their findings showed no significant effects of memory support on anxiety-state as measured by the State-Trait Anxiety Inventory but, the predicted memory support x anxiety-state interaction was found for errors.

Tennyson and Woolley (1971) investigated the interaction of anxiety with performance on two levels of task difficulty. In their experiment they used a self-instructional concept acquisition program which was divided into difficult and easy sections based on empirically

determined probability ratings of the positive instances and negative instances. The prediction of a disordinal interaction was tested using measured anxiety levels as one effect and task difficulty level as other effect. In this experiment anxiety also was measured by the State-Trait Anxiety Inventory (STAI) and blood pressure. The scores for anxiety on the STAI A-State scale increased significantly for the 29 college students during the difficult task and decreased with the easy task ($P < .01$). When the difficult task and the easy task were compared, a disordinal interaction resulted, that is, the relative mean error performance of the high A-State subjects and the low A-State subjects was reversed ($P < .05$).

O'Neil (1972) conducted a study to find out the effect of stress on State anxiety (A-State) and on performance in computer-assisted mathematical task for female college subjects who differed in anxiety proneness (A-Trait). In the stress condition, subjects received negative feedback about performance; the subjects in the non-stress condition were given a brief rest period. The high A-Trait subjects in the stress condition showed a significantly greater initial increase in A-State than did the low A-Trait subjects. During the learning task, a different pattern of changes was noted. Level of A-State for high A-Trait subjects in the stress condition decreased, while for the low A-Trait it remained relatively constant. In the non-stress condition, the changes in A-State for high and low A-Trait subjects were parallel. High A-State subjects made significantly more errors than low A-State subjects on the easier sections of the computer-assisted instruction task, but not on most difficult.

The important feature of the above studies has been application of certain treatments in some way to compensate what the students were not able to do for themselves. Provision of treatments such as memory support (Sieber, 1969) or nonstress condition (O'Neil, 1972) diminished the difference of scores between high- and low-anxious persons. If lowering the anxiety level of Ss, by ways of different type of treatments, would change Ss level of task performance they are engaged in, then this matter should be accurately evaluated and other treatments in this line should be developed to help Ss with different anxiety level for better task performance.

Most of the studies in terms of ATI and anxiety (Sieber et al., 1969; Leherissey et al., 1971) have differentiated between different measures of anxiety, i.e. test anxiety, A-State and A-Trait, but failed to distinguish between the various types of memory processes. Thus, memory has been poorly defined. One of the problems in interpreting and comparing these studies has been the tasks used have been different and could conceivably have required different kinds of memory processes. Therefore, it seems useful to define memory more precisely by investigating memory processes in a more refined way.

This study goes beyond what has been already investigated, by using Posner's (1965) theoretical scheme in terms of which specific memory processes (information conservation, in which all of the input information must be presented, or information reduction, in which a subset of the stimulus input must be produced, Posner, 1965) are affected by which types of anxiety by using high and low stress instructions to elicit anxiety for examining the effect of these two types of stress on these two types of memory processes.

Dependent and Independent Variables

The purpose of this study was to investigate the effect of subjects' aptitudes (anxiety) in relation to two types of memory processes when two different types of instructional treatments are administered. A dependent variable or criterion (Hunk et al., 1974) in this study will be performance on tasks of memory processes measures.

When aptitude and instructional treatments interact, then different results from these treatments can be compared by regressing the aptitude measure on task performance. Following this procedure, a relationship can be established between processor's characteristics and instructional variables that influence the performance. Within this frame work, therefore, anxiety scores will be the predictors or independnet variables. The predictors are: Test Anxiety Scale, General Anxiety Scale, Trait-State Anxiety Inventory.

Statement of Hypotheses

Based upon the previously reviewed research and theories, the following hypotheses formulated and tested:

1. There is no differential relationship between level of anxiety and information processing task upon the amount of recall among college students.

2. Provision of differential instructions will not change the task performance between high- and low-anxious students.

CHAPTER II
EXPERIMENTAL DESIGN

The Design

No experiment in any field is free from error, but to be aware of the possible sources of error and what can be done in order to overcome is an important step in a design. There are two salient ways of minimizing the amount of error (1) the way a study is designed and (2) the statistical technique used in analyzing the data. In order to minimize the threat of various sources of experimental error in terms of internal and external validity the sources of invalidity (internal replicability and external generalizability) will be considered. In terms of internal invalidity sources such as: (1) History - other events occurring between first and second measurement in addition to the experimental treatment. (2) Maturation - biological or psychological process which systematically vary within a person with passage of time per se, independently of experimental treatment or other events. (3) Testing-effects of a pre-test on subsequent observed behavior. (4) Instrumentation changes in measuring instrument itself, or in observers or raters. (5) Regression - universal tendency of extreme scores to be closer to mean on second test. (6) Selection - pre-treatment inequality of experimental groups by means of inadequate assignment of individual to treatment. (7) Mortality - differential loss of person from treatment groups. (8) Selection-Maturation Interaction - affect obtained when treatment grcups have different maturation rates must be controlled.

In terms of external invalidity sources such as: (1) Testing and x interaction - testing effect in which a pretest increases or decreases individual sensitivity or responsiveness to the treatment and thus the experimental results for pretested individuals different from what they would have been without the pretest. (2) Selection and x interaction - biases resulting from lack of wide representative sampling. (3) Reactive Arrangements - artificial and unusual aspects of treatments, such as student's knowledge of participation in experiment. (4) Multiple-x-Interference - a problem whenever multiple treatments are applied to the same persons, because the effects of prior treatments are not usually erasable (Campbell and Stanley, 1966) must be considered.

The kind of experimental design used in this study is illustrated in Table 1. Where:

R = random assignment of students to comparison group

X = exposure of subjects to an experimental condition, following aptitude measurement (Test Anxiety Scale, General Anxiety Scale, A-State and A-Trait Inventory) which in this study there were two different types of instructions (low stress instruction and high stress instruction).

O = observation and measurement on task performance based on two types of memory processes.

The possible sources of concern in terms of internal and external invalidity for this design will be "Interaction of Selection and X" and "Reactive Arrangement" in which both imply to external invalidity (Campbell and Stanley, 1966). According to Campbell and Stanley (1966) all of the factors of internal invalidity are controlled in this design.

TABLE 1

Post-Test-Only Control Group Design.

Aptitude Measures	Treatment		Posttest
TAS, GAS, STAI & two different types of memory tasks	R	X_1	0
TAS, GAS, STAI & two different types of memory tasks	R	X_2	0

Subjects

One hundred undergraduate students from different major areas enrolled during winter quarter 1977 at the University of Florida were randomly selected. Among the participating subjects some were given course credit for their experimental activity, some were paid ($2.00 per hour) for their participation and some were volunteers. Each student was given a code number for test identification to protect his or her identity. The students were run in small groups of from 6-19 students; a total of 12 experimental sessions were conducted to include all groups of students. The experimental mortality rate was six, therefore, the total number of subjects who completed the experiment was 94 (N = 94).

Some of the characteristics of the sample studied appear in Table 2 which provides the distribution of subjects by sex, year in college, and age. Although the subjects ranged in age from 19 to 34 years, the variability was small with most of the ages falling near the mean of 21.0. Prior to and independent of the experimental situation, Ss had been administerred the Test Anxiety Scale (TAS) (Sarason, 1972), General Anxiety Scale (GAS) (Sarason, 1972), and the State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1968).

Aptitude Measures

Test Anxiety Scale (TAS)

A 37-item Test Anxiety Scale was administered and scored in the usual fashion. The mean of the scores on Test Anxiety Scale for both groups combined was 13.68 with a standard deviation of 9.11.

TABLE 2

Number of Sample Subjects by Sex, Years in College, and Age (N = 94).

Treatment Group	N	Sex		Years in College				Age
		M	F	1	2	3	4	
Low Stress Instructions	47	24	23	0	0	38	09	19-34
High Stress Instructions	47	23	24	0	6	30	11	19-24

Each subject was randomly assigned to one of the two experimental treatments. Assignment of subjects to any one treatment was made without experimenter knowledge of the level of test anxiety of the subject.

This 37-item scale used in this experiment represents an expansion of the previously reported 16-item Test Anxiety Scale (Sarason and Ganzer, 1962). The correlation of the 37-item TAS with the shorter one was reported to be .93 (Sarason et al., 1968). Some questions in the Test Anxiety Scale are provided in Appendix A.

General Anxiety Scale (GAS)

This 17-item General Anxiety Scale was administered and scored in the usual True-False fashion. The mean of the scores on GAS for both groups combined was 5.94 with standard deviation of 4.46. Sample questions in the General Anxiety Scale (GAS) are provided in Appendix A.

State-Trait Anxiety Inventory (STAI)

This is a standardized instrument devised by Spielberger et al. (1968) to assess anxiety. This inventory is comprised of separate, self-report scale for measuring two distinct types of anxiety; State anxiety (A-State) and Trait anxiety (A-Trait) as defined by Spielberger (1972).

The STAI A-State Scale consists of 20 statements that ask the subject how he or she feels at a particular moment in time. The STAI A-Trait Scale also consists of 20 item statements, but subject respond to these items by indicating how he or she generally feels. The STAI

A-State and A-Trait scale are printed in a two-page test form. The A-State Scale is designed to measure transitory states, that is, subjective, consciously perceived feelings of apprehension, tension, and worry that vary in intensity and fluctuate over time. The A-Trait Scale measures relatively stable individual differences in anxiety proneness, that is, differences between subjects in the tendency to experience an anxiety state (Spielberger, 1972).

The STAI A-Trait Scale requires the subject to respond to each item by indicating the frequency of occurrence of the behavior described by that time. For example item 32, ("I lack self-confidence.") the subject responds to one of these alternatives: almost never, sometimes, often, or almost always. The scoring weights assigned to almost never, sometimes, often and almost are 1, 2, 3, and 4, respectively, for all of the STAI A-Trait items. These four measures of anxiety were treated as covariates through data analysis.

Task Performance

In task performance all subjects were presented with 8 digits (Posner and Rossman, 1965) in which each digit was selected at random (fishbowl technique)(Fox, 1969) with restriction that no two successive digits were similar. The random selected digits were 6, 1, 2, 7, 3, 6, 7, 4. A total of four tasks (reversal, addition, classification, and recall, respectively) were required of the subject (processor) to process the input information. Therefore, consideration was given to the number of correct answers. It will be recalled that according to Posner (1965) these four tasks represent two different types of memory

processes. Recall and reversal represent information conservation, while classification and addition represent information reduction.

Treatment Procedures

There were ninety-four undergraduate Ss who participated in this experiment (all answered the anxiety questionnaires completely). To all subjects a six page questionnaire, consisting of 95 questions, including, Test Anxiety Scale (37 items), General Anxiety Scale (17 items), A-State questions (20 items), and A-Trait questions (20 items) were administered. On the backs of pages 5, 4, 3, and 2 the following tasks, reversal, addition, classification, and recall, were required from Ss.

Each S was randomly assigned to one of two treatment conditions: the low stress instructions in which there was no indication of S being evaluated: i.e. his or her success in future or in school work has nothing to do with these tasks; and the high stress instructions in which there were some points indicating that S being evaluated and his or her performance in these tasks predict course grades and success in later life (Sarason, 1960). After the subjects were given a brief introduction to the experiment, directions for each task were read to them and the experimenter practiced one example for each task with the same set of numbers. The average time for Ss to finish these 95 questions was 30 minutes. The directions for tasks were as follows:

Task 1. Reversal. In this task you are required to record in the back of your questionnaire, where it says task 1, reversal, each pair of digits in the reverse order from their presentation.

Task 2. Addition. In this task you are required to add two adjacent digits of your reversal form and write down the sum on the next page in the back of your

questionnaire; please be sure not to go back to the previous page.

Task 3. Classification. In this task you are required to classify each pair of numbers (reversal form) into high-odd (50 and above), and low-even (below 50). Please record your answers on the next page in the back of your questionnaire. Be sure not to go back to the previous page.

Task 4. Recalling. In this task you are required to recall all of the numbers (8 digits) in the order which was presented, and write down on the next page in the back of your questionnaire where it says task 4, recalling. Do not go back to the previous pages.

The average time spent reading directions and practicing examples was 15 minutes. All of the Ss received the same brief introduction to the experiment, the same directions, the same numbers (digits) for practice and same digits for actual tasks.

Following the practice the experimenter asked if Ss had any questions concerning the tasks. Then Ss were asked to turn to the back page of their questionnaire and turn to the page which was titled task 1, reversal. Following this procedure the experimenter read 8 digits with the rate of 2 sec. per digit. Ss had 15 seconds to write down their answers. Then the experimenter asked the Ss "please go to the next page and do the next task, addition." Again Ss had 15 seconds to write down their answers. The same procedure was done for task 3, and task 4. Each correct response on any task received 1 point, therefore, there was a total of 4 possible points.

Instructional Treatment

Prior to reading directions for each task one of the following two instructional treatments (low stress and high stress instruction, Sarason and Palola, 1960) were read to Ss.

Low Stress Instructions

> I am conducting a research project on how interesting different kinds of tests and tasks are. After completing the test I am about to give you, I am going to ask you to rate the test in terms of how you enjoyed it. I want to make it clear that this is an experimental test and has nothing to do with yout I.Q. or success in any course offered at the University of Florida. I appreciate this contribution which you are making to a better understanding of the psychology of individual preferences.

High Stress Instructions

> The test you are about to take is considered to be part of an intelligence scale for adults. The similar test has been found to predict such things as course grades, success in later life, and to some extent the kind of personality you possess. Of course your own intelligence will primarily determine whether you do well or poorly on this test. Your task is to perform as well as you possibly can. At a latter date there will be an opportunity for you to compare your I.Q. with those of other people in your group. You will then be able to determine how your abilities and capacities compare with other people like you.

Methods of Data Collecting

The experimenter recorded the TAS, GAS, and STAI information, scored as prescribed by their authors, on the top of the page for each S. The data were recorded on a data sheet. The format as shown in Appendix A. Then from these forms, necessary data were transferred to IBM cards. Duplicate sets of data cards were made in order to facilitate data analysis and maintain data security. Key punching, scoring, and analysis were performed by the experimenter.

Data Analysis

For analysis of the data, a multiple regression analysis was used (Nie et al. SPSS Language Package, 1975; Kerlinger and Pedhazur, 1973).

Multiple regression is a way of identifying and optimizing variance in common between multiple independent variables as a set and a dependent variable. In multiple regressions we are concerned with what relative contribution each independent variable has to the common variance and outcome measure.

The logic for using multiple regression for the analysis of data in this study included the following reasons: 1. It has better predicting power. 2. Every continuous measure, i.e. anxiety measures, or task performance requires only one degree of freedom. 3. Multiple regression analysis retains all of the information and at the same time takes account of the effect of several factors simultaneously.

CHAPTER III
RESULTS

The primary objectives proposed in this study were:

1. to examine the relationship between level of Test Anxiety, General Anxiety, A-State, and A-Trait Anxieties, and performance on different level of complexity of information processing tasks requiring two types of memory processes among college students, and
2. to explore the effect of individual differences on task performance under differential instructions.

This chapter will describe the statistical tests of the hypotheses and the results obtained. The presentation of results will first treat an analysis of the instructional treatment which will be followed by an analysis of aptitude x treatment interactions. The analysis were computed using the University of Florida Statistical Program facilities Northeast Regional Data Center, and the SPSS Language Package.

Independent and Dependent Variables

Independent variables are those variables whose properties are manipulated in an experiment. The criterion variable or the dependent variable refers to the variables which the experimenter examines to see if it is affected in some way by experimental manipulation of the independent variables. This study included independent variables described as aptitudes and the differential instructions in the task performance

situation. Dependent variable or criterion variables included four different tasks requiring two different types of memory processes; information conservation and information reduction. Independent variables and dependent variables to be analyzed appear in Table 3.

Intercorrelations Among Variables

Intercorrelation of independent and dependent variable were computed for the total sample. Intercorrelations among the independent variables (Table 4) for four measures of anxiety display moderate correlations ranging from .39 to .79 with one another. The highest being between Test Anxiety Scale and General Anxiety Scale (.79). A-State and A-Trait display moderately low correlations with one another and this is in accord with the expectations regarding these measures of different types of anxiety. Therefore, they tend to be independent of each other.

Intercorrelations among the dependent variables (four tasks: 1. Reversal, 2. Addition, 3. Classification, 4. Recalling) display (Table 4) some higher correlations among reversal-addition, and reversal-classification respectively. The highest correlation was found between addition and recalling, however, the theoretical assumption that two distinct types of memory processes are represented in Tasks 1 and 4 (Information Conservation) and Tasks 2 and 3 (Information Reduction) is supported by this data.

Distribution of Scores Within Variables

Means, and standard deviation and distribution of both independent and dependent variables by treatment were computed for each of two experimental groups. The means and standard deviations for the dependent variables are shown in Table 5, and for the dependent variables in

TABLE 3

Independent and Dependent Variables.

INDEPENDENT VARIABLES	DEPENDENT VARIABLES
1. Test Anxiety Scale (TAS)	Information Transformation Tasks
2. General Anxiety Scale (GAS)	1. Reversal
3. A - State	2. Addition
4. A - Trait	3. Classification
5. Treatment 1 (Low Stress Instructions)	4. Recalling
6. Treatment 2 (High Stress Instructions)	

TABLE 4

Intercorrelations of Anxiety Measures and Each Task: Total Sample.

	1	2	3	4	5	6	7	8
1. Test Anxiety Scale (TAS)		79	59	75	-30	-18	-07	-16
2. General Anxiety Scale (GAS)			51	67	-16	-07	-07	-12
3. A - State				39	-31	-30	-14	-32
4. A - Trait					-24	10	08	09
5. Task 1 (Reversal)						43	18	32
6. Task 2 (Addition)							33	56
7. Task 3 (Classification)								28
8. Task 4 (Recalling)								

Decimals omitted

N = 94

TABLE 5

Mean and Standard Deviations for Aptitude Measures.

TREATMENT			Cov. 1 TAS		Cov. 2 GAS		Cov. 3 A-State		Cov. 4 A-Trait		Y TASK	
CONDITION		n	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Group I male	Treatment I	24	16.16	8.06	7.66	4.14	35.62	14.59	46.79	7.23	2.20	1.22
Group II female	Treatment I	23	14.82	8.82	6.78	4.31	45.04	13.41	43.60	8.27	2.34	.96
Group III male	Treatment II	23	9.26	8.57	3.39	3.70	32.26	14.62	41.26	4.82	2.04	1.36
Group IV female	Treatment II	24	14.33	9.24	5.87	4.38	38.91	16.58	44.25	4.35	1.29	1.09

Table 6. It must be mentioned that in some cases where standard deviation is larger than mean this indicates skewed distribution which are likely to increase "r." Results in Tables 5 and 6 are derived from the analysis of independent variables (four measures of anxiety, sex, two treatments).

While sex was not of major interest of this study, the information was readily available and was therefore included in the analysis. Occasionally sex differences have arisen with respect to anxiety, but it is not a topic about which one can safely generalize.

Instructional Treatment and Interaction

The following hypothesis was of major concern with respect to instructional treatment and interaction:

> Subjects with high anxiety (Test Anxiety, General Anxiety, A-State, and A-trait) receiving treatment with low stress instructions will exhibit significantly greater task performance than those anxious students (in regard with the same anxiety variable measures) with high stress instructions.

However, an additional question of major interest was whether the two different memory processes, information conservation, and information reduction, would be affected by the different measures of anxiety in a similar manner.

Subjects were randomly assigned to one of two experimental groups, low stress instructions and high stress instructions in the test situation. After explaining the directions for the tasks materials to be answered, all subjects took the same type of materials and tasks. The

TABLE 6

Means and Standard Deviations of Dependent Variables.

Task Performance Measure		Treatment Group					
		Low Stress Instruction			High Stress Instruction		
		Mean	S.D.	n	Mean	S.D.	n
Reversal	T1	.89	.30	47	.76	.42	47
Addition	T2	.77	.42	47	.42	.49	47
Classification	T3	.15	.36	47	.12	.33	47
Recalling	T4	.49	.49	47	.34	.47	47

tasks consisted of four types of information transformation requiring specific memory processes, including reversal, addition, classification, and recalling of 8 digit numbers which were read to subjects prior to task performance.

It will be recalled that according to Posner (1965) reversal and recalling tasks are considered as one type of memory process, in which the subjects are required to reproduce what informations were given to them; addition and classification on the other hand, were considered as different type of memory process, in which the subjects were required to represent subset of the given informations.

Multiple regression analysis (SPSS) was used to determine if there were significant instructional treatment effects on various scores of each task individually and two (reversal and recalling) by two (addition and classification) tasks which subjects performed. When the interactions between two factors (i.e. test anxiety and treatments) in multiple regression analysis, where variables in the equation were significant B weights of that particular step was used in comparison of two treatments.

The order in which variables were entered into analysis for each task separately, for tasks involving information conservation, and information reduction was as follows:

Step 1. Four measure of anxiety (four covariates).

Step 2. Treatments.

Step 3. Sex.

Step 4. Treatment x sex.

Step 5. Test Anxiety x Treatments.

Text Anxiety x Sex

Test Anxiety x Treatment x Sex.

Step 6. General Anxiety x Treatments.

General Anxiety x Sex.

General Anxiety x Treatment x Sex.

Step 7. A-State x Treatments.

A-State x Sex.

A-State x Treatment x Sex.

Step 8. A-Trait x Treatments.

A-Trait x Sex.

A-Trait x Treatment x Sex.

Main Effects

With regard to main effects in this study the following results were disclosed:

1. There were significant relationships between anxiety measures (treated as four covariates, Test Anxiety, General Anxiety, A-State, and A-Trait) as a set, and performance on the task(s). These relationships did not remain constant across the two instructional treatments. The following results were obtained from Step No. 1. of multiple regression analysis when four covariates as a set with respect to task(s) entered in the equation.

Task 1 (T1), Reversal, $F = 3.53$, $P < .01$.

Task 2 (T2), Addition, $F = 6.19$, $P < .001$.

Task 3 (T3), Classification, $F = 1.53$, $P < .50$.

Task 4 (T4), Recalling, $F = 5.45$, $P < .001$.

T1 & T4, Information Conservation, $F = 5.35$, $P < .01$.

T2 & T3, Information Reduction, $F = 5.75$, $P < .01$.

Therefore, these results showed significant relationships between four measures (covariates) and performance except for task 3, classification. According to Posner (1965), it takes longer to classify a two-digit number into odd and even than to name it even though the classification task requires processing of only the final digit.

2. There were significant differences between the two instructional treatments for all tasks and their combinations except task 3, classification ($F = 1.27$, $P < .50$) as follows:

Task 1 (T1), Reversal, $F = 3.99$, $P < .05$.

Task 2 (T2), Addition, $F = 9.89$, $P < .01$.

Task 3 (T3), Classification, $F = 1.27$, $P < .50$.

Task 4 (T4), Recalling, $F = 5.33$, $P < .05$.

T1 & T4, Information Conservation, $F = 6.02$, $P < .05$.

T2 & T3, Information Conservation, $F = 7.28$, $P < .01$.

The above results were obtained from Step No. 2 of multiple regression analysis when two treatments (low stress instructions, and high stress instructions) with respect to task(s) entered in the equation. Therefore, the instructional treatments differentially affected Ss performance on the above task(s) (between subjects differences). In each case low stress instruction produced significantly higher performance than high stress instructions.

Multiple regression analysis was done for aptitude treatment interaction with respect to each task separately and tasks involving information conservation (reversal and recalling) and information

reduction (addition and classification) holding four covariates (four anxiety measures), sex, treatment and treatment x sex constant.

Task 1 (T1), Reversal

This task required the subjects to recall each pair of digits (8 digits) in the reverse order from their representation. The results for the multiple regression analysis of the frequency of correct responses to reversal task are presented in Tables 7 and 8.

Significant interactions were found between treatment and General Anxiety Scale (GAS) for the reversal task ($F = 10.67$, $P < .005$) at the sixth step and for A-State ($F = 8.27$, $P < .01$) at the seventh step of the equation. While no significant differences were found for Test Anxiety Scale (TAS) ($F = 1.69$, $P < .25$), and A-Trait ($F = .44$, $P < .75$). The plot of interactions (Figures 5 and 6) show the direction for interactions for GAS with treatment, and for A-State with treatments. The direction of the differences for TAS and A-Trait correspond to the GAS pattern.

The final equation and procedures for calculations are shown in Appendix B, Tables 18, 19 and 20. For the low stress treatment the relation between General Anxiety and Task 1 (Reversal) was negative, but for the high stress treatment the relation between General Anxiety and Reversal Task was positive. For the low stress treatment as A-State increases Task 1 (Reversal) increases also, but for high stress instruction A-State had no relationship with performance.

Task 2 (T2), Addition

This task required the subjects to add two adjacent digits (from previous task, reversal form) and record the sum. The results for the multiple regression analysis of the frequency of correct response to addition task are provided in Tables 9 and 10.

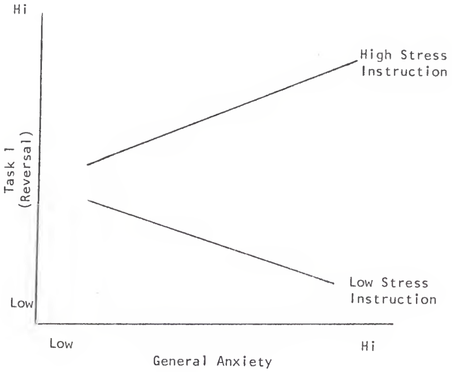

Figure 5. Interaction of general anxiety with instructional treatments for Task 1 (Reversal).

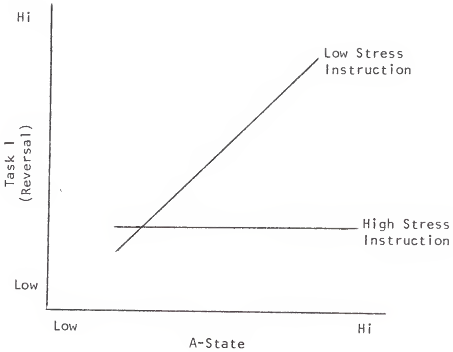

Figure 6. Interaction of A-State with instructional treatments for Task 1 (Reversal).

TABLE 7

Variables in the Equation of Multiple Regression Analysis (Step No. 6) with Respect to Task 1. (Reversal).

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	.00	.00	.00	.00
General Anxiety (B)	-.01	-.02	.01	.84
A - State (C)	.00	.00	.00	.00
A - Trait (D)	-.01	-.21	.00	1.76
Treatment (E)	-.04	-.10	.07	.26
Sex (F)	.04	.11	.06	.41
E X F (G)	.00	.00	.06	.00
A X E	-.01	-.69	.00	3.65
A X F	-.00	-.18	.00	.27
A X G	-.00	0.23	.00	.45
B X E	.06	1.22	.01	10.67**
B X F	-.00	-.11	.01	.09
B X G	.01	.37	.01	1.13

* P<.05 ** P<.01

Note: This is the step at which interaction 4,5,6 (GAS X treatments. GAS X Sex and GAS X treatment X Sex respectively) entered; each account for 1 df.

TABLE 8

Variables in the Equation of Multiple Regression Analysis (Step No. 7) with Respect to Task 1. (Reversal)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.00	-.059	.00	.07
General Anxiety (B)	-.06	-.73	.02	7.19**
A - State (C)	.01	.53	.00	4.74*
A - Trait (D)	-.01	-.26	.00	2.85
Treatment (E)	.30	.82	.14	4.85*
Sex (F)	-.05	-.15	.13	.18
E X F (G)	.25	.67	.14	3.25
A X E	-.00	-.33	.00	.79
A X F	-.01	-.46	.00	1.54
A X G	.00	.19	.00	.28
B X E	.10	1.95	.02	19.22***
B X F	-.03	-.66	.02	2.10
B X G	.03	.75	.02	2.73
C X E	-.01	-1.84	.00	8.27**
C X F	.00	.90	.00	1.96
C X G	-.01	-1.33	.00	4.30*
(Constant)	1.29			

* P<.05, ** P<.01, *** P<.001

TABLE 9

Variables in the Equation of Multiple Regression Analysis (Step No. 5) with Respect to Task 2. (Addition)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.01	-.36	.00	6.06*
General Anxiety (B)	.01	.15	.01	1.45
A - State (C)	-.00	-.28	.00	7.47**
A - Trait (D)	.02	.27	.00	4.51*
Treatment (E)	-.10	-.21	.07	1.90
Sex (F)	.06	.14	.06	1.00
E X F (G)	.03	.07	.07	.27
A X E	.02	.70	.00	19.63***
A X F	-.00	-.18	.00	1.80
A X G	-.00	-.25	.00	2.91
(Constant)	.18			

* P<.05, ** P<.01, *** P<.001

TABLE 10

Variables in the Equation of Multiple Regression Analysis (Step No. 6) with Respect to Task 2. (Addition)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.00	-.17	.00	1.05
General Anxiety (B)	-.01	-.13	.01	.57
A - State (C)	-.00	-.19	.00	2.69
A - Trait (D)	.02	.28	.00	4.75*
Treatment (E)	-.12	-.24	.07	2.28
Sex (F)	.04	.09	.07	.46
E X F (G)	.03	.06	.07	.21
A X E	.00	.12	.00	.17
A X F	.00	.15	.00	.29
A X G	-.02	-.67	.00	5.66*
B X E	.04	.68	.02	5.23*
B X F	-.02	-.36	.01	1.58
B X G	.03	.51	.01	3.25
(Constant)	.06			

* $P<.05$

Significant interactions were found between treatment and Test Anxiety (TAS) $F = 19.64$, $P < .001$), and treatment and General Anxiety (GAS) ($F = 5.23$, $P < .05$). While no significant differences were found for A-State ($F = 1.24$, $P < .50$) and A-Trait ($F = 0$). The plot of interactions (Figures 7 and 8) show the directions of interactions for Test Anxiety Scale and General Anxiety Scale.

As Figures 7 and 8 show the low stress instructional treatment the relation of Test Anxiety and General Anxiety with performance on the Addition Task was negative, but for the high stress treatment the relation was positive.

The final equation and procedures for calcualtions are shown in Appendix B, Tables 21, 22, and 23.

Task 3 (T3), Classification

In this task the subjects were required to classify each pair of numbers (from T1, Reversal) into high-odd (50 and above), and low-even (number below 50).

Results from the multiple regression analysis of the frequency of correct responses to T3 (Classification) are provided in Table 11. No significant interactions were found between treatment and any of anxiety measures; Test Anxiety Scale, $F = 2.80$, $P < .10$; General Anxiety Scale, $F = 0$; A-State, $F = .17$, $P < .75$; and A-Trait, $F = 0$.

Task 4 (T4), Recalling

In this task the subjects were required to recall all of the numbers (8 digits) in the order which was presented to them. Results for the multiple regression analysis of the frequency of correct responses to T4 are provided in Tables 12 and 13.

Significant interactions were found between treatment and Test Anxiety ($F = 11.83$, $P < .001$), treatment and A-Trait ($F = 5.11$, $P < .05$)

TABLE 11

Variables in the Final Equation of Multiple Regression Analysis (Step No. 8) with Respect to Task 3 (Classification)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.01	-.29	.00	1.29
General Anxiety (B)	-.00	-.07	.02	.05
A - State (C)	.00	.17	.00	.37
A - Trait (D)	.00	.17	.00	.81
	-.14	-.43	.38	.15
Treatments (E)	.14	.43	.38	.15
Sex (F)	.08	.25	.38	.05
E X F (G)	.00	.34	.00	.55
A X E	-.00	-.20	.00	.19
A X F	.00	.33	.00	.53
A X G	-.00	-.13	.02	.06
B X E	.01	.24	.02	.21
B X F	.01	.28	.02	.29
B X G	.00	.31	.00	.18
C X E	-.00	-.63	.00	.75
C X F	-.00	-.96	.00	1.72
C X G	-.00	-.07	.00	.00
D X E	.00	-.07	.00	.00
D X F	.00	.24	.00	.03
D X G	.00	.11	.00	.00
(Constant)	-.275			

TABLE 12

Variables in the Equation of Multiple Regression Analysis (Step No. 5) with Respect to Task 4. (Recalling)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.01	-.24	.00	2.04
General Anxiety (B)	.00	.01	.01	.00
A - State (C)	-.00	-.25	.00	4.49*
A - Trait (D)	.02	.33	.01	5.09*
Treatment (E)	-.17	-.35	.08	3.75
Sex (F)	-.09	-.18	.08	1.26
E X F (G)	-.20	-.41	.08	6.04*
A X E	.01	.62	.00	11.83***
A X F	.00	.12	.00	.00
A X G	.00	.25	.00	2.34
(Constant)	-.23			

* P<.05, *** P<.001

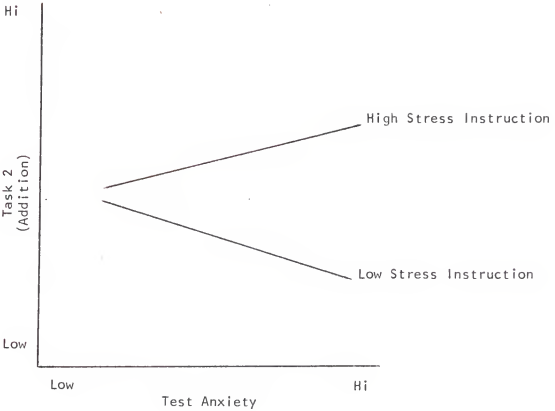

Figure 7. Interaction of test anxiety with instructional treatment for Task 2 (Addition).

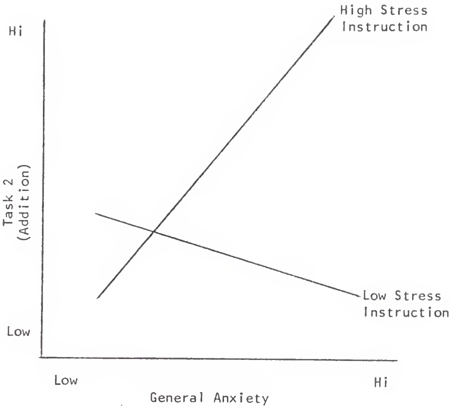

Figure 8. Interaction of general anxiety with instructional treatment for Task 2 (Addition).

for recalling task. While there were no significant differences found for GAS ($F = 1.53$, $P < .05$), and A-State ($F = .41$, $P < .75$) with respect to treatments.

The plot of interactions show the effects of TAS and treatment, and for A-Trait and treatment. Comparison between treatment conditions (Figs. 9 and 10) showed for the low stress instructional treatment the relation of test anxiety with performance on the Recalling Task was negative, but for the high stress treatment the relation was positive. For the low stress treatment and high stress treatment the relation between A-Trait and T4, Recalling, was positive, but more strongly positive for the high stress instruction.

The final equation and procedures for calculations are shown in Table 13 and in Appendix B, Tables 24 and 25.

Task 1 and Task 4, "Information Conservation"

It was anticipated that treatment effects might manifest themselves by an increase in the frequency of correct responses for combining the results of T1 (reversal) and T4 (Recalling) or as a total task "Information Conservation" in some groups and a related decrease in the frequency of correct responses for others. Tables 14, 15, and 16 presents the results for the multiple regression analysis of information conservation.

Significant interactions were found between treatment and Test Anxiety Scale (TAS) ($F = 9.64$, $P < .005$); between treatments and General Anxiety Scale (GAS) ($F = 7.48$, $P < .01$), and between treatments and A-State for information conservation tasks ($F = 4.50$, $P < .05$). While no significant differences were for A-Trait ($F = 3.84$, $P < .10$).

TABLE 13

Variables in the Final Equation of Multiple Regression Analysis (Step No. 8) with Respect to Task 4. (Recalling)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.00	-.18	.01	.82
General Anxiety (B)	-.04	-.41	.02	2.68
A - State (C)	-.00	-.04	.00	.04
A - Trait (D)	.01	.25	.01	2.96
Treatments (E)	-.86	-1.74	.42	4.06*
Sex (F)	.85	1.73	.42	4.02*
E X F (G)	.41	.83	.42	.93
A X E	.00	.05	.01	.02
A X F	.02	.90	.01	6.25*
A X G	.01	.45	.01	1.60
B X E	.02	.36	.02	.77
B X F	-.01	-.24	.02	.33
B X G	.03	.58	.02	1.93
C X E	-.00	-.61	.00	1.13
C X F	-.00	-.23	.00	.16
C X G	-.00	-.67	.00	1.37
D X E	.02	2.27	.01	5.11*
D X F	-.02	-2.29	.01	5.18*
D X G	-.01	-1.21	.01	1.45
(Constant)	-.046			

* $P<.05$

TABLE 14

Variables in the Equation of Multiple Regression Analysis (Step No. 5) with Respect to Tasks 1 and 4. (Information Conservation)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.02	-.31	.01	3.14
General Anxiety (B)	.01	.12	.04	.62
A - State (C)	-.01	-.29	.00	5.94*
A - Trait (D)	.01	.14	.01	.92
Treatment (E)	-.15	-.22	.13	1.47
Sex (F)	-.02	-.03	.11	.04
E X F (G)	-.19	-.27	.12	2.60
A X E	.02	.57	.00	9.64**
A X F	-.00	-.08	.00	.25
A X G	.00	.19	.00	1.23
(Constant)	1.23			

* $P<.05$, ** $P<.01$

TABLE 15

Variables in the Equation of Multiple Regression Analysis (Step No. 6) with Respect to Tasks 1 and 4. (Information Conservation)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.00	-.06	.01	.11
General Anxiety (B)	-.04	-.26	.03	1.61
A - State (C)	-.00	-.15	.00	1.22
A - Trait (D)	.01	.14	.01	.95
Treatment (E)	-.20	-.28	.13	2.27
Sex (F)	-.07	-.10	.11	.39
E X F (G)	-.21	-.29	.12	3.01
A X E	-.00	-.21	.01	.39
A X F	.01	.27	.01	.67
A X G	-.01	-.32	.01	.95
B X E	.09	.94	.03	7.48**
B X F	-.03	-.35	.03	1.14
B X G	.06	.64	.03	3.81
(Constant)	1.00			

* $P<.05$, ** $P<.01$

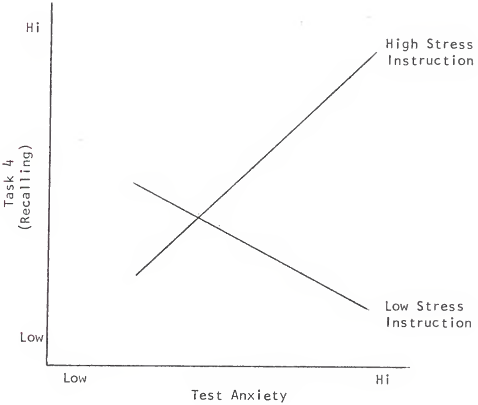

Figure 9. Interaction of test anxiety with instructional treatments for Task 4 (Recalling).

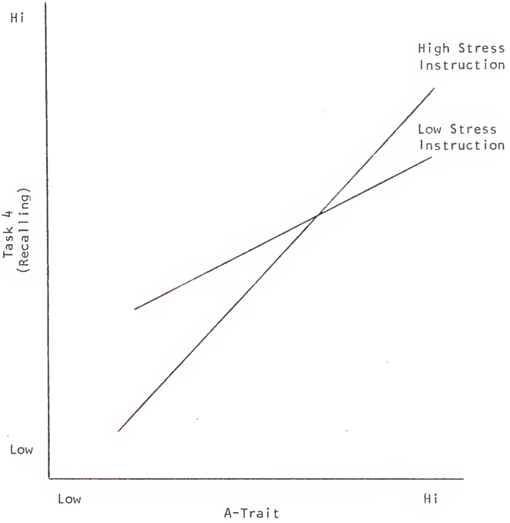

Figure 10. Interaction of A-Trait with instructional treatments for Task 4 (Recalling).

The plot of interactions (Figures 11, 12 and 13) show the directions for TAS, GAS, and A-State. The comparison between treatment conditions showed for the low stress instruction the relation between Test Anxiety and performance (information conservation) was negative, but there was almost no relation between Test Anxiety and performance under the high stress instructional treatment (Figure 11). While for the low stress instructions and high stress instruction the relation between GAS and performance on information conservation tasks was negative (Figure 12), but more strongly negative for the high stress condition. In terms of A-State, for the low stress instruction the relation between A-State and performance on information conservation tasks was positive, but for the high stress instructions the relation between A-State and performance was negative (Figure 13).

The final equation and procedures for calculation are shown in Appendix B, Tables 25, 26, 27 and 28.

Task 2 and Task 3, "Information Reduction"

The results of both scores on Task 2 (Addition) and Task 3 (classification) or "Information Reduction" are shown in Table 17. The interaction between treatment and both tasks combined was significant for TAS ($F = 15.99$, $P < .001$). There was no significances found for GAS ($F = 2.16$, $P < .25$), for A-State ($F = 1.0$, $P < .50$), and for A-Trait ($F = 0$). The plot of interaction (Figure 14) showed the directions for interaction for TAS with treatment.

The comparison between treatment conditions showed for low stress treatment, the relation between Test Anxiety and performance on

TABLE 16

Variables in the Equation of Multiple Regression Analysis (Step No. 7) with Respect to Tasks 1 and 4. (Information Conservation)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.00	-.10	.01	.27
General Anxiety (B)	-.10	-.67	.04	7.35**
A - State (C)	.01	.27	.01	1.47
A - Trait (D)	.00	.07	.01	.23
Treatment (E)	.24	.34	.24	.99
Sex (F)	.00	.00	.24	.00
E X F (G)	.30	.43	.24	1.58
A X E	.00	.01	.01	.00
A X F	.00	.19	.01	.32
A X G	.00	.14	.01	.16
B X E	.13	1.42	.03	12.16***
B X F	-.07	-.73	.04	3.07
B X G	.07	.82	.04	3.89
C X E	-.02	-1.24	.01	4.50*
C X F	.00	.22	.01	.14
C X G	-.02	-1.25	.01	4.51*
(Constant)	.97			

* $P<.05$, ** $P<.01$, *** $P<.001$

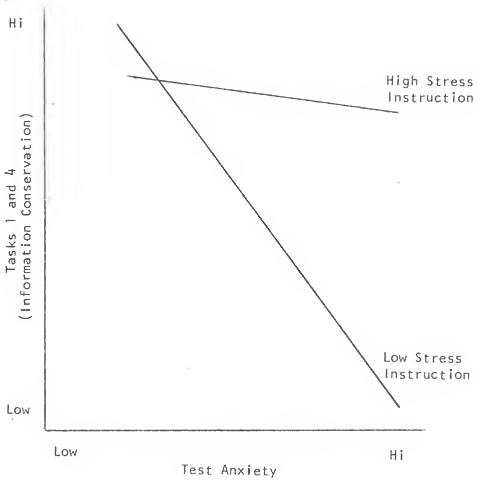

Figure 11. Interaction of test anxiety with instructional treatments for Tasks 1 and 4 (Information Conservation).

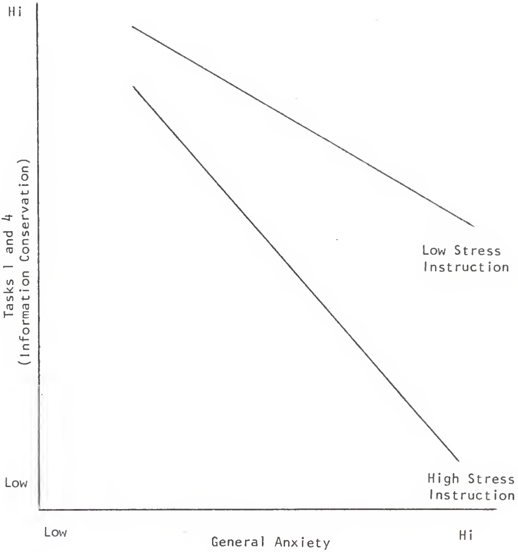

Figure 12. Interaction of General Anxiety with instructional treatments for Tasks 1 and 4 (Information Conservation).

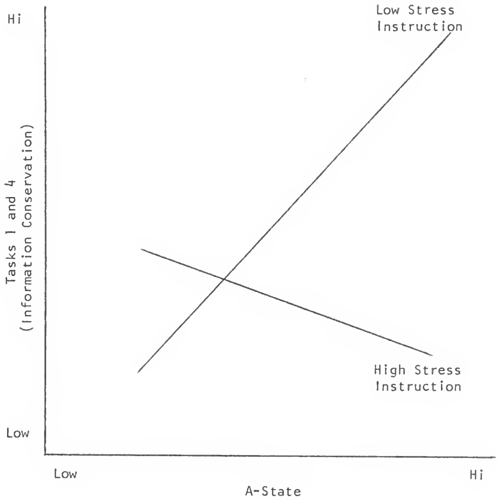

Figure 13. Interaction of A-State with instructional treatments for Tasks 1 and 4 (Information Conservation).

TABLE 17

Variables in the Equation of Multiple Regression Analysis (Step No. 5) with Respect to Tasks 2 and 3. (Information Reduction)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.02	-.34	.01	4.59*
General Anxiety (B)	.01	.08	.02	.38
A - State (C)	-.00	-.22	.00	3.93*
A - Trait (D)	.03	.31	.01	5.16*
Treatment (E)	-.2	-.27	.11	2.64
Sex (F)	.13	.19	.10	1.68
E X F (G)	-.05	-.07	.10	.21
A X E	.02	.68	.00	15.98***
A X F	-.00	.21	.00	1.99
A X G	-.00	-.07	.00	.22
(Constant)	-.10			

* $P<.05$, *** $P<.001$

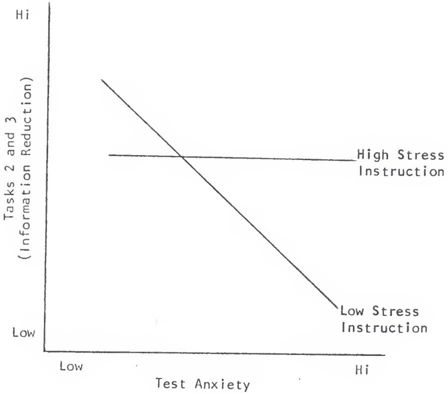

Figure 14. Interaction of test anxiety with instructional treatments for Tasks 2 and 3 (Information Reduction).

information reduction tasks was negative, but for high stress instruction Test Anxiety had no relationship with performance.

The final equation and procedures for calculations are provided in Appendix B, Tables 30 and 31.

Aptitude x Treatment Interactions

The following hypothesis was a major concern to aptitude treatment interactions:

> There will be differential relationship between task performance and aptitudes of students, relative to the treatment received.

Aptitude treatment interactions were evaluated by comparison of regression slopes for two different types of treatments, using F-tests for heterogeneity of regression. These tests were subsequently performed to determine the significance of individual regression lines for each treatment.

As it was mentioned previously (Koran, 1973) the major theoretical contributions underlying investigation of aptitude x treatment interactions is educational adaptation to individual differences in the learner. Instruction can be adapted only if there are alternative treatments which lead to the goal, and the major characteristic is only if the regression of criterion scores on aptitude scores have the disordinal pattern, as shown in Figure 3.

In this study while the results of all regression analysis have been computed, only the results of analyses in which significant interactions occurred have been presented.

Evaluation for Aptitude x Treatment Interaction

Aptitude measure can be treated as continuous variables or categorical variables. In this study Test Anxiety scores, General Anxiety scores, A-State scores, A-Trait scores, and task performances within each treatment group were treated as continuous variables. These are variables which are capable of taking on an ordered set of values within a certain range (Kerlinger, 1973). Therefore, the values of a continuous variable reflect at least a rank order, a large value of the variable meaning more of the property in question than a smaller value. The value yielded by a scale to measure test anxiety, for instance, expresses differing amounts of anxiety over the test taking situation from high through medium to low.

Sex of subjects in this study was treated as a dichotomous categorical variable. The individual being categorized either has the defining property or does not have it. As Kerlinger (1973) points out it is an "all-or-none" kind of thing.

A preliminary step in evaluating aptitude x treatment interactions was to compute regression equations for all task measures with respect to anxiety measures and treatments. Of 28 F-tests computed to test heterogeneity of regression only 13 significant interactions were found. This procedure was taken for selecting anxiety variables for the analysis of aptitude x treatment interactions for each task separately, for Task 1 and 4 (Information Conservation), for Task 2 and 3 (Information Reduction). Of 14 (sex included) tests for heterogeneity for regression slope computed

computed for task(s) performances, 11 disordinal interactions were found.

Task Performance Measures

T1, (Reversal). Results of regression analysis of aptitude x treatment interactions, using the frequency of correct responses of the Reversal Task as a criterion measure are shown in Tables 7 and 8 and in Appendix B, Tables 18, 19 and 20. These analyses show that scores on General Anxiety Scale and A-State produced significant disordinal interactions with the frequency of correct responses, while the interactions for TAS and A-Trait were insignificant. In the case of General Anxiety Scale, high scores for GAS were negatively related to performance in the low stress instruction; but positively related to High Stress Instruction. Therefore, low stress instruction did not help Ss with high General Anxiety than High Stress Instructional Treatment, while those scoring low in General Anxiety performed better with High Stress Instructional Treatment.

In terms of T1 (Reversal) performance and A-State, high scores for A-State were positively related to performance in the Low Stress Instructions while there was no relation to High Stress Instruction. In this case Low Stress Instruction helped Ss with high A-State.

The obtained relationship between scores on General Anxiety and A-State with respect to Task 1 are illustrated in Figures 5 and 6.

T2, (Addition). The evaluation of aptitude x treatment interactions for scores on T2 (Addition) in Tables 9 and 10 and in Appendix

B, Tables 21, 22 and 23 showed that scores on Test Anxiety Scale displayed significant disordinal interactions with the frequency of correct responses, while the interactions for A-State and A-Trait were insignificant. In both cases high scores for Test-Anxiety, and General Anxiety were negatively related to performance in the Low Stress Instruction, while positively related to High Stress Instruction. Therefore, Low Stress Instruction did not help Ss with high Test Anxiety and high General Anxiety than High Stress Instructional treatment. Those scoring low in GAS and TAS performed better with High Stress Instructional treatment.

The obtained relationship between scores on Test Anxiety, and General Anxiety with respect to <u>Task 2 (Addition)</u> are illustrated in Figures 7 and 8.

<u>T4, (Recalling)</u>. The results of regression analyses obtained with the frequency of correct responses to <u>Task 4 (Recalling)</u> as the criterion measure are presented in Tables 12 and 13 and in Appendix B, Tables 24 and 25 with regard to Test Anxiety, A-State and A-Trait respectively. The results showed significant disordinal interactions for Test-Anxiety and A-Trait. In both cases high scores Test-Anxiety and A-Trait were positively related to performance (<u>Recalling</u>) in High Stress Instruction than Low Stress Instruction. Those Ss scoring low in Test Anxiety and A-Trait performed better with High Stress Instructional Treatment concerning T4.

The obtained relationship between scores on Test Anxiety, and A-Trait with respect to <u>T4 (Recalling)</u> are shown in Figures 9 and 10.

<u>T1 and T4, (Information Conservation)</u>. The evaluation of aptitude x treatment interactions for scores on T1 (Reversal) and T4 (Recalling)

combine, as Information Conservation showed that scores on TAS, GAS, and A-State in Tables 14, 15, and 16 and in Appendix B, Tables 26, 27, 28 and 29 displayed significant disordinal interactions with the frequency of correct answers, while the interactions for A-Trait were insignificant. High scores for Test-Anxiety was positively related to High Stress Instructional Treatment; therefore, Low Stress Instruction did not help highly text-anxious Ss for Task 1 and Task 4 involving Information Conservation, but performance of Ss with high Test Anxiety and High Stress Instruction comparing with former group was better.

In terms of General Anxiety high scores for GAS was negatively related to performance in both Low and High Stress Instruction. These results indicate that Low Stress Instruction did not help those with high General Anxiety and the same was true for High Stress Instruction.

With respect to A-State, high scores for A-State was negatively related to performance with High Stress Instruction but positively related to Low Stress Instruction. Therefore, Ss with high A-State did perform better with Low Stress Instruction than high Stress Instruction.

The obtained relationship between scores on Test-Anxiety, and A-State with respect to Information Conservation is illustrated in Figures 11, 12 and 13.

T2 and T3, Information Reduction). Results for regression analysis of aptitude x treatment interactions using the frequency of correct responses to Information Reduction as a criterion measure are shown

in Table 17 and in Appendix B, Tables 30 and 31. The analyses indicate scores on Test Anxiety produced significant disordinal interactions with the frequency of correct answers, while the interaction for GAS, A-State, and A-Trait were insignificant.

High scores for Test Anxiety was negatively related to performance in Low Stress Instruction, while positively related to High Stress Instruction. Therefore, high test anxious Ss benefited more from High Stress Instruction than Low Stress Instruction in Information Reduction Tasks.

CHAPTER IV
DISCUSSION AND IMPLICATIONS

Summary of Data: Hypotheses Tests

This study sought to examine the effect of anxiety (Test Anxiety, General Anxiety, A-State, and A-Trait) in relation to two different types of memory processing tasks with respect to two different kinds of instructional treatments. The basic hypotheses tested in this study include the following:

1. Both high anxious and low anxious students perform the same in regard to correct responses for information conservation and reduction tasks.
2. Provision of differential instructions (Low and High Stress Instruction) will not change the task performance between high and low anxious Ss in information conservation and reduction tasks.

Specific predictions, although tentative, were based on theoretical considerations which suggests that requirements of different modes of instructional treatments were sufficiently different to produce different ability-performance relationships.

Main Effects

Support for hypothesis 1 is dependent on a significant relationship between anxiety and performance on the two types of informational transforms.

Data in Tables 7 through 17 also in Appendix B strongly support these hypotheses. With respect to four different measures of anxiety (test anxiety, general anxiety, A-State, and A-Trait) given to all the Ss, both Low Stress Instruction and High Stress Instructional condition anxiety was a significant predictor of performance. Each task was measured separately first and then 2x2 (Reversal and Recalling representing information conservation and Addition and Classification representing information reduction).

The nature of these four tasks appear to have been an important factor in the results obtained. It has been observed that instructional treatments resulted in large intersubject variability. This finding is consistent with earlier studies (Lazurus and Erikson, 1952; Sarason, 1956). Sarason (1957) inferred that this increased variability among Ss was in part attributable to individual personality differences in task performance and in addition to instructions. The findings in this experiment of interactions between anxiety and different instructional conditions indicate the importance of assessing personality differences among experimental groups.

Two possible theoretical interpretations suggest themselves on the basis of the findings concerning the relationship between anxiety and the two instructional conditions used. One, a drive interpretation, stems from Spence (1958) view that the performance of high anxious subjects will be inferior to that of low anxious subjects on complex or difficult tasks in which competing error tendencies are stronger than correct responses. In contrast, on "simple learning tasks" in which correct responses are dominant relative to incorrect response

tendencies, it would be expected that the performance of high-anxious subjects would be superior to that of low-anxious subjects. It must be mentioned that the tasks used in this experiment were considered complex in nature, because Ss were dealing with 8 digit numbers while it has been hypothesized that the span of immediate memory in humans is limited to seven digits (Miller, 1956). Subjects were required to process input information (8 digits) to information conservation (Reversal and Recalling) and information reduction (Addition and Classification) task performances. Therefore, it seems in this experiment there are two levels of complexities rather than a unitary learning task. High Stress Instructions were facilitative for some students and detrimental for others with respect to performance on different tasks. It might be hypothesozed that High Stress Instruction increased the general drive level of Ss, whereas Low Stress Instruction left it unchanged. In this study for high scorers on the Test Anxiety Scale, performance was high with respect to more complex tasks (Information Reduction) Figures 7, 8, and 14.

A similar hypothesis places greater emphasis on associative (habit) factors (Mandler and Sarason, 1952; Sarason, 1956). Such an hypothesis would consider high anxious Ss to have learned certain detrimental responses to situations similar to that with which Ss were confronted in the present experiment. As Sarason (1956) points out, high anxious subjects might place a high premium on excellence of performance in situations in which their behavior is being evaluated (e.g. taking an intelligence test) and might verbalize to themselves

during their performance about the importance of a high level of attainment. Quite conceivably such verbalization could have an interfering and detrimental effect on their performance. For low-anxious Ss on the other hand, high motivating instructions may act as a stimulus for increased effort in the performance of the task(s) with which they are confronted.

The present study failed to show a significant relationship between Test Anxiety and A-Trait and treatments for Information Conservation (Reversal task); A-State, A-Trait and treatments for Information Reduction (Addition task); Test Anxiety, General Anxiety, A-Trait and treatments for Information Reduction (Classification task); General Anxiety and treatments for Recalling task when each task was analyzed separately. Also with the two by two combination of tasks there was no significant relationship or interaction between A-Trait and treatments for Inforamtion Conservation (Reversal and Recalling); General Anxiety; A-State, A-Trait and treatments for Information Reduction (Addition and Classification). The two instructional treatments produced highly similar effects on performance with regard to Test Anxiety and Addition (Figure 7) General Anxiety and Addition (Figure 8); Test Anxiety and Inforamtion Reduction (Figure 14). With respect to the information reduction tasks, performance of high anxious groups given high stress motivational instruction was superior to those given low stress instructions.

The second group of similar effects were found on performance for Test Anxiety and Recalling (Figure 9), A-Trait and Recalling (Figure 10); Test Anxiety and Information Conservation (Figure 11).

The apparance of these variety of interactions between performance, anxiety measures, and treatments seems related to the complexity of task(s). Many tasks which require transformation of input (stimuli) involve information reduction. The tasks falling within general category may differ rather widely. However, within relatively restricted task configurations the amount of information reduced appears to be a quantitative predictor of task difficulty. In this experiment Addition and Classification tasks were in this catagory according to Posner and Rossman (1965).

However, in the present study, the Posner theory that the Information Conservation tasks (reversal and recalling) and the Information Reduction tasks (addition and classification) represent two relatively pure and qualitatively different memory processes, was not supported by the data. The Correlational data showed (Table 4) that the Information Conservation tasks were no more highly correlated with the Information Reduction tasks than they were with each other. This information is important in view of the fact that Posner (1965) did not provide correlational data of this type in reporting his research using the memory tasks.

It was found that (Posner and Rossman, 1965) for a set of simple numerical tasks the errors increased and the rate of processing decreased as the amount of information reduction required by the task increased. As it will be recalled, in this study one of the tasks (T2) required Ss to add two adjacent digits together and the other task (T3) required the Ss to classify each pair of numbers into high and odd (50 and above), low and even (50 and below). For this set of tasks the amount of information reduction is directly related to task difficulty. Review of these results suggests that tasks consisting information reduction under high stress

instructional conditions have been generally more effective for subjects high in test anxiety and general anxiety. In regard to Inforamtion Conservation (Reversal and Recalling) which requires less complex processing comprised only of retention and relocation of input information, low stress instructions was facilitative and high stress instruciton had debilitating effects with respect to high A-State (Figure 13).

Aptitude x Treatment Interactions

Hypothesis 2 implies interaction between aptitude and treatmert. The statistical tests of this hypothesis are F-tests for heterogeneity of regression.

The evidence with respect to hypothesis 2 consists of interactions between Low Stress Instructional Treatment and High Stress Instructional Treatment in terms of the anxiety measure (four measures) and informational transforms.

It will be recalled that, four measures of anxiety were considered as aptitude. Aptitude has been defined as any characteristic of individual which facilitates or interferes with his learning from some designated instructional method (Cronbach and Snow, 1969).

Of the ten aptitude factors studied, the following significant interactions with treatment conditions and relative to performance on two distinct memory processes were found. These significant interactions were as follows:

1. General Anxiety and treatment conditions with respect to the Reversal task.
2. A-State and treatment conditions with respect to the Reversal task.

3. Test Anxiety and treatment conditions with respect to the Addition task.
4. General Anxiety and treatment conditions with respect to the Addition task.
5. Test Anxiety and treatment conditions with respect to Recalling task.
6. A-Trait and treatment conditions with respect to the Recalling task.
7. Test Anxiety and treatment conditions with respect to the Combined Information Conservation tasks.
8. General Anxiety and treatment conditions with respect to the Combined Information Conservation tasks.
9. A-State and treatment conditions with respect to the Combined Information Conservation tasks.
10. Test Anxiety and treatment conditions with respect to the Combined Information Reduction tasks.

There were no interactions involving task 3 (Classification). It seems among four tasks given to subjects, task 3 was the most difficult one and only a few people answered it correctly. Therefore, there was probably not enough variance concerning task 3 (Classification).

Analysis of aptitude x treatment interactions showed that scores on frequency of correct responses on High and Low Stress Instructional conditions interacted significantly with one of the information reduction tasks, and also with both information conservation tasks. For Low Stress Instructions the relation between Test Anxiety and/or General Anxiety and performance on Information Reduction tasks was negative,

but for the High Stress Instructional treatment the relation between Test Anxiety and/or General Anxiety and Information Reduction was positive. With respect to Information Conservation for Low Stress Instructional Treatment the relation between A-State and performance on Information Conservation tasks was positive, but for High Stress Instructional Treatment the relation between A-State and Information Conservation was negative.

The analysis of these interactions with different tasks, (Figures 5 through 14) indicate that Ss who scored low on Test Anxiety and/or General Anxiety with respect to information reduction tasks (as defined by Posner, 1965) such as Addition and Classification benefited more from the Low Stress Instructional treatment than the High Stress Instructional treatment; and the opposite results were obtained for Information Conservation tasks with respect to A-State. It is worth noting that interactions were obtained for A-State only with the simpler information conservation tasks while test anxiety and general anxiety were interacted with both types of tasks.

Stimuli in this experiment were 8 digit numbers which were read to Ss, and two different types of treatments (Low Stress Instruction and High Stress Instruction). According to Bartlett (Posner, 1965) there are three types of thinking in a thought system. First, there is thinking within a closed system in which the response is in some way implicit in the stimulus input. This is clearly the case in Information Reducing transform. Within the closed system Bartlett discusses a type of mental activity which is called "translation" and in

which there is a one to one correspondence between two coding schemes such as Information Conservation. And finally, Bartlett suggested there is an open system in which the subject uses the evidence available in the stimulus to leap beyond the input and provide a new and creative solution. This is similar to "Information Creation Notion" (Posner, 1965).

The presentation of Low Stress Instruction could serve as a compensatory function for Ss with high A-State or Information Conservation tasks. Similarly, the high stress instruction may be expected to arouse the most anxiety and therefore exert the more debilitating effect on memory task performance.

By comparing two sets of tasks, Information Reduction and Information Conservation, the direction of interactions with respect to A-State can be interpreted to suggest that for Information Conservation tasks, Low Stress Instruction "may" generally serve a compensatory function for highly anxious subjects. Low Stress Instruction does manipulate indeed an evaluational Stress Condition for Ss with high A-State and low performance on complex tasks, and its compensatory function is preventing the arousal of anxiety which interferes wtih memory task performance. Conversely, high stress condition may generate better performance for low A-State subjects. These results are in accord with what was anticipated and results of similar previous studies (Seiber et al., 1969).

However, the opposite effects were consistently found for interactions involving Test Anxiety Scale, General Anxiety Scale and Trait Anxiety. Apparently, as Speilberger has suggested, the A-State measure was sensitive to aspects of anxiety not measured by TAS, GAS and A-Trait. This suggestion is also supported by the correlation among the anxiety measures in which

the correlation between A-State and the other more general anxiety measure was generally lower than those between the more general anxiety measure themselves.

The compensatory function may be illustrated in the case of those interactions involving A-State and classification. There are two types of classification. In the first type, aspects of the stimulus input may be ignored in making the classification. This type represents selection of information. For example, if a subject is asked to classify playing cards by color, the suit and value may be completely ignored. This class of task is said to involve "gating" (Posner, 1965). The second type of classification according to Posner requires every aspect of the input stimulus to be processed and represented in the response, but in a condensed form. In this experiment classification of the latter form were used in which Ss were required to classify two digit numbers into high and odd, low and even. These are called condensation tasks. In classification tasks (i.e. condensation) therefore, the degree of retention depends upon the complexity of the task.

Fitts (reviewed by Posner, 1965) has suggested that the amount of mental processing and thus, performance, in a serial task is a direct function of the number and complexity of steps to be taken. However, in many tasks, it is difficult to specify the sequence of steps through which the subject must pass. For example, in classification task it is not at present possible to state each step which intervenes prior to the emergence of the correct response. Performance in task requiring information reduction or information conservation depends on how much processing the subject must do with input materials. High Stress

performance for information conservation. Conversely in tasks requiring information conservation Low Stress Instruction and High Stress Instruction had opposite effects for the other measures of anxiety.

Results such as these are not completely unknown in the literature, for example: in O'Neil's (1972) study it was found that High A-State subjects made significantly more errors than Low A-State subjects on the easier sections of the computer-assisted instruction task, but not on the most difficult. In this study, perhaps that is one reason why there were no interactions with A-State and the more complex information reduction tasks. Possible reasons for that would be:

1. Correlation of A-State with other measures was relatively low suggesting it was measuring something different than others.
2. Degree of task difficulty may be differently related to the different anxiety measures; for example, with the difficulty level of the tasks used in this study it may produce the expected direction of interaction for A-State. But a higher (or lower) degree of difficulty may be necessary to produce the same pattern of interaction for the more general measures of anxiety (GAS, A-Trait). Therefore, in the future one might conduct an experiment in which there are several tasks at several different levels of difficulty and observe the pattern of results at each stage.
3. Or the experimental "High Stress" instructions were not sufficiently threatening to elicit the degree of anxiety anticipated to produce the expected interactions with respect

to more general measures of anxiety, although the A-State measure was made sensitive to the High Stress Instruction.

In this study four measures of anxiety were tested in order to examine which anxiety measure(s) was (were) involved with input information and being processed in the mediational phase (r_m s_m). Aptitude x treatment interaction were disclosed between Information Conservation (Figure 13) and Information Reduction (Figure 14). It has appeared that in the more complex tasks (Information Reduction) High Stress Instruction, GAS and A-State had positive relations with performance. While A-State had negative relations with performance, the opposite was true for Low Stress Instruction. It seems in this case those Ss who were capable of performing on more complex tasks with respect to High Stress Instruciton were capable of controlling their anxieties (Test Anxiety/General Anxiety) or to use them constructively not to interfere with their performance. While on the complex tasks (Information Conservation) High Stress Instruction with respect to A-State lowered task performance. Therefore, in this case the Low Stress Instructional Treatment had compensatory function and did not have interfering effect on processing involved in the mediational phase. As Sieber (1969) indicated that:

> When anxiety is regarded as a process variable, concern is shifted to the mutual relationship between anxiety, cognitive process variables and overall task performance. It is assumed that each variable may affect any other variable.

By examining the effect of anxiety on selected cognitive processes then it seems we will be able to alter the relevant conditions in ways to maximize the facilitating effects of anxiety and to prevent its debilitating effects from coming into the mediating process. Therefore, ways must be discovered through which all anxious Ss be taught to handle their anxieties in a constructive way.

As it was mentioned previously, it is not at present possible to conclude processes in which Ss went through in order to get to response integration in tasks involving Information Reduction. Thus, there seems to be a need for a theory of the processes involved in remembering.

It should be mentioned that the correlational data did not support Posner's hypothesis that the four different tasks represented two relating pure but distinctly different types of memory processes. Further research will be required to determine whether this conception of memory will be useful or whether new and different conceptualizations will be required.

It will be recalled that in this study there were two major categories of four different tasks: 1. Information Conservation which consisted of Reversal and Recalling tasks in which Ss were required to preserve all of the input information in his response and, 2. Information reduction which consisted of Addition and Classification in which Ss were required to prcduce a subset of the stimulus input. Of two major types of memory prccesses studied, there have been two aptitude x treatment.

1. Performance of Information Conservation (T1 and T4) and A-State with respect to two instructional treatments showed (Figure 13) for the Low Stress Treatment the relation between A-State and performance on Information Conservation was positive, but for the High Stress Instruction the relation between A-State and performance on Information Conservation was negative. In other words while Low Stress Instructional Treatment worked well for high scorers on A-State,

High Stress Instructional Treatment had debilitating effects on performance of Ss with high A-State. It seems Ss with high anxiety (A-State) could chold only small amounts of information in storage and the Low Stress Condition helped them to do more attention and treatment compensated their interfering anxiety. However, the opposite results were obtained using A-Trait measure.

2. All interactions with other measures of anxiety for both Information Conservation and reduction tasks showed that for those who received Low Stress Instructional Treatmetn the relation between anxiety and performance on Information Reduction was negative, but for those Ss who received High Stress Instructional Treatment, anxiety and performance on these two tasks (T2 and T3) was generally positive. It seems while the High Stress Instrucitonal Treatment worked best for high anxiety Ss, the Low Stress Instructional Treatment failed to facilitate high performance for Ss with high anxiety.

Implications for Future Research

This study represents an attempt to examine the effects of two differential instructional treatments with regard to performance on two levels of complexity of information transform. The obtained results suggest that additional research with other motivating instructional conditions with respect to anxiety level of Ss should be assessed, because of the complicated relationship between performance on task complexity and the effects of anxiety. According to the usual

formulation of this relationship (Spence, 1958), anxiety facilitates performance on "very simple" tasks and hampers performance on "complex tasks." In other words anxiety facilitates behavior when the dominant response (the best-learned response) is correct and hampers performance when the dominant response is incorrect (Martin, 1976). In this study, for Information Reduction tasks, the dominant response seems to increase with higher "drive" i.e. High Stress Instruction, which causes less dominant responses not to compete as strongly with the dominant response. In very complex tasks in which the dominant response is not correct, all responses, both right and wrong, are increasing in strength, and they conflict with one another. This relationship seems to hold except at very high drive levels at which all responses are so strongly motivated that "freezing" behavior (Martin, 1976) occurs. In this case Ss are motivated to make all of their conflicting responses at once, so they can make none of them. The implication of this situation for example, on exam taking is that if the individual has learned the material to be tested extremely well, anxiety should help him/or her to do better; otherwise, anxiety just confuses the individual more because he/she cannot discriminate from among the possible answers. Specifically it seems this is true for multiple choice items in which all the possible alternatives seemed to say exactly the same thing. In this study performance on very complex tasks (Addition and Classification) depended upon correct performance on less complex tasks (Reversal) which acted as dominant response.

As it was mentioned previously when anxiety regarded as a process variable (Sieber, 1969), our concern is shifted to the mutual relation-

ship between anxiety and task performance. Therefore analysis of the effects of this process variable with regard to task performance requires further research investigation in order to construct a model which can be used for performance on a given set of tasks involving highly complex information transform.

With respect to memory, if we assume that individuals differ in the speed and efficiency of recoding process (Melton, 1967), then it is clear that a valid theory for the interpretation of memory functions (short term or long term) must include individual differences measure of recoding processes employed in the storage of information. The sooner our experiments and our theory on human memory consider the differences between individuals in our experimental analyses of component processes in memory, the sooner we will have theories and experiments that have some substantial probability of reflecting the fundamental characteristics of those processes. As Melton proposes that when we are able to deal with the "genotypical" processes at the level of the individual learner, we will have the predictive efficiency we all seek.

The results reported in this investigation indicate that different instructional conditions facilitate task peformance in some subjects while debilitating effects on task performance of others, with such differences being related to Ss aptitude (anxiety measures) and nature of the task(s).

Finally, further investigation on analysis of intellectual performance in terms of informational transformations, immediate memory different instructional treatments and interactions of these processes can provide tools adequate to the analysis of significant questions in human thinking.

Summary

This study was designated to examine the assumption of interactions between (a) anxiety (test anxiety, general anxiety, A-State, and A-Trait), (b) high and low instructional treatments, and (c) two distinct memory processes. The tasks used were 8 digit numbers to be processed as reversal, addition, classification, and recalling.

Analyzing the data by means of multiple regression analysis, significant Test Anxiety x Instructional Treatment interactions emerged. Test Anxiety was related to Ss performance more frequently than was General Anxiety, A-State, and A-Trait when scores on two tasks required more information reduction were combined. A-State was related to Ss performance more frequently than was Test Anxiety, General Anxiety, and A-Trait when scores on two tasks required more information conservation were combined. In general it appeared that the more complex tasks (Information Reduction) and High Stress Instruction had facilitative effects on high test anxious subjects. In contrast, on "less complex" tasks (Information Conservation) it appeared that Low Instructional Treatment had facilitative effects for Ss with high scores on A-State. The obtained results confirmed previous findings based on Spence's Drive theory with respect to A-State, but not with respect to the other measures of anxiety used. In addition, the data did not support Posner's basic conceptualization of memory processes. It was concluded that further investigation should be attempted to examine analysis of intellectual performance in terms of mediational responses (recoding) and interactions.

APPENDICES

APPENDIX A

SAMPLES OF FOUR MEASURES OF ANXIETY

AND

SAMPLE OF DATA CODING SHEET

Test Anxiety Scale (TAS) Item

(T) 1- While taking an important exam I find myself thinking of how much brighter the other students are than I am.

(T) 2- If I were to take an intelligence test, I would worry a great deal before taking it.

(F) 3- If I knew I was going to take an intelligence test, I would feel confident and relaxed, beforehand.

(T) 4- While taking an important examination I perspire a great deal.

(T) 5- During course examinations I find myself thinking of things unrelated to the actual course material.

(T) 6- I get to feel very panicky when I have to take a surprise exam.

(T) 7- During tests I find myself thinking of the consequences of failing.

(T) 8- After important tests I am frequently so tense that my stomach get upset.

(T) 9- I freeze up on things like intelligence tests and final exams.

(T) 10- Getting a good grade on one test doesn't seem to increase my confidence on the second.

(T) 11- I sometimes feel my heart beating very fast during important tests.

(T) 12- After taking a test I always feel I could have done bettwe than I actually did.

(T) 13- I usually get depressed after taking a test.

(T) 14- I have an uneasy, upset feeling before taking a final exam.

(F) 15- When taking a test my emotional feelings do not interfere with my performance.

(T) 16- During a course examination I frequently get so nervous that I forget facts I really know.

(T) 17- I seem to defeat myself while working on important tests.

(T) 18- The harder I work at taking a test or studying for one, the more confused I get.

(T) 19- As soon as an exam is over I try to stop worrying about it, but I just can't.

(T) 20- During exam I sometimes wonder if I'll ever get through college.

(T) 21- I would rather write a paper than take an examination for my grade in a course.

(T) 22- I wish examinations did not bother me so much.

(T) 23- I think I could do much better on tests if I could take them alone and feel pressured by a time limit.

(T) 24- Thinking about the grade I may get in a course interferes with my studying and my performance on tests.

(T) 25- If examination could be done away with I think I would actually learn more.

(F) 26- On exam I take the attitude, "If I don't know it now there's no point worrying about it."

(F) 27- I really don't see why some people get so upset about tests.

(T) 28- Thoughts of doing poorly interfere with my performance on my tests.

(F) 29- I don't study any harder for final exam than for the rest of my course work.

(T) 30- Even when I am well prepared for a test, I feel very anxious about it.

(T) 31- I don't enjoy eating before an important test.

(T) 32- Before an important examination I find my hands and arms trembling.

(F) 33- I seldom feel the need for "cramming" before an exam.

(T) 34- The university ought to recognize that some students are more nervous than others about tests and that this affects their performance.

(T) 35- It seems to me that examination periods ought not to made the tense situations which they are.

(T) 36- I start feeling very uneasy just before getting a paper back.

(T) 37- I dread courses where the professor has the habit of giving "pop" quizzes.

General Anxiety Scale (GAS) Items

(T) 1. I freeze up in a competitive situation.

(T) 2. I worry about my mental health more than do most people.

(T) 3. I worry about my social adjustment more than do most people.

(T) 4. I am a high-strung person.

(T) 5. I wish I could be as happy as others seem to be.

(T) 6. I don't seem to be able to control worrying about something even when I know there is no basis for it.

(F) 7. I practically never blush.

(T) 8. When I have to talk to a group I get very anxious.

(F) 9. I am usually calm and not easily upset.

(T) 10. I perspire a lot when I am with a group of strangers.

(T) 11. I sometimes become so excited that I find it hard to get to sleep.

(T) 12. When I go to the doctor I worry that he will tell me that something is wrong with me.

(T) 13. I am inclined to take things hard.

(T) 14. I have had periods in which I have lost sleep over worry.

(T) 15. I have been afraid of things or people that I know could not hurt me.

(T) 16. I am easily embarrassed.

(T) 17. I have periods of such restlessness that I can not sit long in a chair.

A-STATE INVENTORY (SAMPLE ITEMS)

1.	I feel calm	1	2	3	4
4.	I am regretful.	1	2	3	4
8.	I feel rested	1	2	3	4
9.	I feel anxious.	1	2	3	4
13.	I am jittery.	1	2	3	4
20.	I feel pleasant	1	2	3	4

A-TRAIT INVENTORY (SAMPLE ITEMS)

2.	I tire quickly	1	2	3	4
4.	I wish I could be as happy as others seem to be. . . .	1	2	3	4
9.	I worry too much over something that really doesn't matter	1	2	3	4
12.	I lack self-confidence	1	2	3	4
14.	I try to avoid facing a crisis or difficulty	1	2	3	4
19.	I am a steady person	1	2	3	4

SAMPLE OF DATA CODING SHEET

SS#		Task 1	Task 2	Task 3	Task 4	TAS	GAS	A-State	A-Trait	Sex	Treatment 1	Treatment 2
1		0	0	0	1	16	06	55	48	2	1	0
5		1	1	0	0	09	01	31	45	1	1	0
13		1	1	0	0	12	13	55	46	2	1	0
19		1	1	1	1	26	10	26	49	1	1	0
25		1	1	0	1	13	05	28	47	1	1	0
48		1	1	0	1	03	02	21	41	1	0	2
55		1	0	0	0	03	02	24	34	2	0	2
67		1	1	1	0	04	02	23	43	1	0	2
94		1	1	1	1	03	00	23	38	1	0	2

Task 1. Reversal

Task 2. Addition

Task 3. Classification

Task 4. Recalling

TAS Test Anxiety Scale

GAS General Anxiety Scale

A - State Stat Anxiety

A - Trait Trait Anxiety

Sex 2 = Female, 1 = Male

Treat 1 = Low Stress Instruction, 2 = High Stress Instruction

APPENDIX B
INTERACTION OF ANXIETY MEASURES AND TREATMENTS WITH RESPECT TO THE TASK(S); AND PROCEDURES FOR CALCULATION OF REGRESSION SLOPES

TABLE 18

Procedures for Calculation of Regression Slope of Tl Performance on GAS for each Treatment

Independent Variable	B Wt	GAS 1 Treatment 0	10 0	1 1	10 1
GAS	-.01	-.01	-.10	-.01	-.10
Treatment	.04	0	0	.04	.04
GAS X Treatment	.06	0	0	.06	.60
$\hat{Y}$	total	-.01	-.10	.09	.54

B Weights obtained from Computer Output

0 = Low Stress instruction

1 = High Stress instruction

1 - 10 Range of Score in GAS

Tl = Reversal

Constant (a) = 1.40

$\hat{Y}\ T_1 = a + B_1X_1 + B_2X_2 + B_3X_1X_2$

X_1 = Range of Score for GAS

B_1 = B weight for GAS

B_2 = B weight for treatment

X_2 = Range of Score for treatment

B_3 = B weight for interaction

TABLE 19

Procedures for Calculation of Regression Slope Of T_1 Performance on A-State For Each Treatment

Independent Variable	B Wt	A-State 20 / Treatment 0	80 / 0	20 / 1	80 / 1
A - State	.01	.20	.80	.20	.80
Treatment	.30	0	0	.30	.30
A-State X Treatment	-.01	0	0	-.20	-.80
$\hat{Y}$	Total	.20	.80	.30	.30

B weights obtained from computer output

0 = Low Stress instruction

1 = High Stress instruction

20-80 Range of Score in A-State

T1 = Task 1 Reversal

Constant (a) = 1.29

$\hat{Y} = a + B1X1 + B2X2 + B3X1X2$

B1 = B weight for A - State

X1 = Range of Score for A - State

B2 = B weight for treatment

X2 = Range of Score for treatment

B3 = B weight for interaction

TABLE 20

Variables in the Final Equation of Multiple Regression Analysis (Step No. 8) with Respect to Task 1 (Reversal)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.00	-.02	.01	.01
General Anxiety (B)	-.07	-.80	.02	8.04***
A - State (C)	.01	.55	.01	5.01*
A - Trait (D)	-.01	-.30	.01	3.18
Treatment (E)	.07	.18	.37	.04
Sex (F)	-.45	-1.20	.37	1.51
E X F (G)	.50	1.34	.37	1.9
A X E	-.01	-.50	.01	1.56
A X F	-.01	-.63	.01	2.25
A X G	.01	.21	.01	.43
B X E	.10	2.0	.02	19.23***
B X F	-.03	-.65	.02	1.88
B X G	.03	.71	.02	2.31
C X E	-.01	-1.88	.00	8.39**
C X F	.01	.84	.00	1.67
C X G	-.01	-1.25	.00	3.69
D X E	.01	.75	.01	.44
D X F	.01	1.23	.01	1.19
D X G	-.01	-.78	.01	.48
(Constant)	1.37			

* P<.05, ** P<.01, *** P<.001

TABLE 21

Procedures for Calculation of Regression Slope of T2 Performance on TAS for each Treatment

Independent Variable	B Wt	TAS / Treatment	1 / 0	37 / 0	1 / 1	37 / 1
TAS	-.01		-.01	-.37	-.01	-.37
Treatments	-.10		0	0	-.10	-.1
TAS X Treatments	+.02		0	0	+.02	.74
$\hat{Y}$	Total		-.01	-.37	.09	.27

B weights were obtained from Computer output

0 = Low Stress Instruction

1 = High Stress Instruction

1-37 Range of Score in Test Anxiety Scale

T2 = Task 2, Addition

Constant (a) = .188

$\hat{Y}$ = a = B1X1 + B2X2 + B3X1X2

B1 = B weight for TAS

X1 = Range of Score for TAS

B2 = B weight for Treatment

X2 = Range of Score for Treatment

B3 = B weight for interaction

TABLE 22

Procedures for Calculation of Regression Slope of T2 Performance on GAS for each Treatment

Independent	B Wt	GAS 1 / Treatment 0	10 / 0	1 / 1	10 / 1
GAS	.01	-.01	-.10	-.01	-.10
Treatments	-.12	0	0	-.12	-.12
GAS X Treatment	.04	0	0	.04	.40
$\hat{Y}$	Total	-.01	-.10	-.09	.18

B weights were obtained from Computer Output

0 = Low Stress Instruction

1 = High Stress Instruction

1-10 Range of Score in General Anxiety Scale

T2 = Task 2, Addition

Constant (a) = .065

$\hat{Y} = A + B1X1 + B2X2 + B3X1X2$

TABLE 23

Variables in the Final Equation of Multiple Regression Analysis (Step No. 8) with Respect to Task 2 (Addition)

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.00	-.05	.01	.07
General Anxiety (B)	-.00	-.06	.02	.07
A - State (C)	-.01	-.42	.00	4.16*
A - Trait (D)	.02	.28	.01	4.17**
Treatments (E)	-.21	-.43	.39	.28
Sex (F)	.19	.40	.39	.24
E X F (G)	.41	.84	.39	1.08
A X E	-.00	-.11	.01	.11
A X F	.01	.41	.01	1.47
A X G	-.01	-.57	.01	2.90*
B X E	.03	.47	.02	1.52
B X F	.00	.04	.02	.01
B X G	.01	.15	.02	.15
C X E	.00	.54	.00	1.01
C X F	-.01	-.99	.00	3.38*
C X G	.00	.71	.00	1.71
D X E	-.00	-.00	.01	.00
D X F	.00	.14	.01	.02
D X G	-.01	-1.30	.01	1.91
(Constant)	.202			

* P<.05, ** P<.01

TABLE 24

Procedures for Calculation of Regression Slope of T4 Performance on TAS for each Treatment

Independent Variable	B Wt	TAS 1 / Treatment 0	37 / 0	1 / 1	37 / 1
TAS	-.01	-.01	-.37	-.01	-.37
Treatment	-.17	0	0	-.17	-.17
TAS X Treatment	.02	0	0	.02	.74
$\hat{Y}$	Total	-.01	-.37	-.16	-.2

B Weights obtained from Computer Output

0 = Low Stress instruction
1 = High Stress instruction
1-37 Range of score in Test Anxiety Scale
T4 = Task 4, Classification
Constant (a) = -.236

$\hat{Y} = A + B1X1 + B2X2 + B3X1X2$

TABLE 25

Procedures for Calculation of Regression Slope of T4 Performance on A-Trait for each Treatment

Independent Variable	B Wt	A-Trait / Treatment	20 / 0	80 / 0	20 / 1	80 / 1
A - Trait	.02		.4	1.6	.4	1.6
Treatment	-.86		0	0	-.86	-.86
A-Trait X Treatment	.02		0	0	.02	1.6
$\hat{Y}$	Total		.4	1.6	-.44	2.36

B Weight obtained from Computer output

0 = Low Stress instruction

1 = High Stress instruction

20-80 Range of Score in A - Trait

T4 = Task 4, Recalling

Constant (a) = -.05

$\hat{Y} = A + B1X1 + B2X2 + B3X1X2$

TABLE 26

Procedures for Calculation of Regression Slope of T1 and T4 (Information Conservation) Performance on TAS for each Treatment

Independent Variable	B Wt	TAS 1 Treatment 0	37 0	1 1	37 1
TAS	-.02	-.02	-.74	-.02	-.74
Treatment	-.15	0	0	-.15	-.15
TAS X Treatment	.02	0	0	.02	.74
$\hat{Y}$	Total	-.02	-.74	-.11	-.15

B weight obtained from Computer output

0 = Low Stress instruction

1 = High Stress instruction

1-37 = Range of Score in Test Anxiety Scale

T5 = T1 & T4 Information Conservation

Constant (a) = 1.24

$\hat{Y} = A + B1X1 + B2X2 + B3X1X2$

TABLE 27

Procedures for Calculation of Regression Slope of T1 and T4 (Information Conservation) Performance on GAS for each Treatment

Independent Variable	B Wt	GAS 1 / Treatment 0	10 / 0	1 / 1	10 / 1
GAS	-.04	-.04	-.4	-.04	-.4
Treatment	-.2	0	0	-.2	- 2
GAS X Treatment	.09	0	0	.09	+.9
$\hat{Y}$	Total	-.04	-.4	-.15	-1.5

B weight obtained from Computer Output

0 = Low Stress instruction

1 = High Stress instruction

1-10 Range of Score in General Anxiety Scale

T1 and T4, Information Conservation

Constant (a) = 1.0

$\hat{Y} = A + B1X1 + B2X2 + B3X1X2$

TABLE 28

Procedures for Calculation of Regression Slope of T1 and T4 (Information Conservation) Performance on A-State for each Treatment

Independent Variable	B Wt	A-State / Treatment	20 / 0	80 / 0	20 / 1	80 / 1
A - State	.01		.20	.80	.20	.80
Treatment	.24		0	0	.24	.24
A-State X Treatment	-.02		0	0	-.02	-.80
$\hat{Y}$	Total		.20	.80	.42	.24

B weight obtained from Computer Output

0 = Low Stress instruction

1 = High Stress instruction

20-80 Range of score in A-State

T1 and T4, Information Conservation

Constant (a) = .98

$\hat{Y}$ = A + B1X1 + B2X2 + B3X1X2

TABLE 29

Variables in the Final Equation of Multiple Regression Analysis (Step No. 8) with Respect to T1 and T4 "Information Conservation"

Variables		B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)		-.01	-.13	.01	.46
General Anxiety (B)		-.11	-.71	.04	7.95**
A - State (C)		.01	.26	.01	1.40
A - Trait (D)		.00	.01	.01	.01
Treatments	(E)	-.79	-1.11	.61	1.64
Sex	(F)	.40	.56	.61	.42
E X F	(G)	.91	1.29	.61	2.20
A X E		-.01	-.23	-.01	.40
A X F		.01	.29	.01	.66
A X G		.01	.45	.01	1.60
B X E		.12	1.33	.04	10.35**
B X F		-.04	-.51	.04	1.47
B X G		.07	.78	.04	3.49
C X E		-.02	-1.42	.01	6.06*
C X F		.00	..28	.01	.24
C X G		-.01	-1.13	.01	3.81
D X E		.03	1.98	.01	3.84
D X F		-.01	-.93	.01	.85
D X G		-.02	-1.26	.01	1.55
(Constant)		1.32			

* P .05, *** P .001

TABLE 30

Procedures for Calculation of Regression Slope of T2 and T3 (Information Reduction) Performance on TAS for each Treatment

Independent Variable	B Wt	TAS 1 Treatment 0	37 0	1 1	37 1
TAS	-.02	-.02	-.74	-.02	-.74
Treatment	-.2	0	0	-.2	-.2
TAS X Treatment	.02	0	0	.02	.74
$\hat{Y}$	Total	-.02	-.74	-.2	-.2

B weight obtained from Computer Output

0 = Low Stress Instruction

1 = High Stress Instruction

1-37 Range of Score for Test Anxiety Scale

T2 and T3, Information Reduction

Constant (a) = -.10

$\hat{Y} = A + B1X1 + B2X2 + B3X1X2$

TABLE 31

Variables in the Final Equation of Multiple Regression Analysis (Step No. 8) with Respect to T2 and T3, "Information Reduction"

Variables	B Weight	Beta Weight	STD Error B	F
Test Anxiety (A)	-.01	-.01	.01	.80
General Anxiety (B)	-.01	-.08	.03	.10
A - State (C)	-.00	-.21	.00	.93
A - Trait (D)	.03	.29	.01	3.68**
Treatments (E)	-.36	-.52	.60	.35
Sex (F)	.34	.50	.60	.33
E X F (G)	.50	.73	.60	.69
A X E	.00	.08	.01	.05
A X F	.00	.19	.01	.27
A X G	-.01	-.02	.01	.43
B X E	.02	.27	.03	.43
B X F	.01	.15	.03	.12
B X G	.02	.25	.03	.36
C X E	.00	.54	.00	.87
C X F	-.01	-1.02	.00	3.10
C X G	.00	.02	.00	.00
D X E	-.00	-.03	.01	.001
D X F	.00	.23	.01	.05
D X G	-.01	-.87	.01	.73
(Constant)	-.072			

* $P<.05$, ** $P<.01$

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BIOGRAPHICAL SKETCH

Kianoosh Hashemian was born on April 25, 1943, in Tehran, Iran. He lived with his parents, Reva and Amir Banoo Hashemian, and two brothers, Shahrokh and Shahriar. He received his early education in Khayam and Jam School, both in Golhak. Upon graduation from high school, he attended medical school for six months and then came to the United States in 1963.

He went to the College of Marin in Kentfield, California for two years and studied pre-medicine. Then he transferred to San Francisco State University and received his B.A. in psychology in 1969 and his M.A. in 1970 in interdisciplinary education and psychology with emphasis on psychological assessment. While he was going to school and studying psychology, he worked as a psychiatric technician at Ross General Hospital, Ross, California, for four years. Those years were so exciting and interesting years to him.

In September 1970, he returned to Iran and served for two years in the military service. After six months military training he worked in one of the military hospitals in the morning and taught psychology courses in the afternoon at Farah Pahlavi University. Whn his military service was finished he continued to teach at Farah Pahlavi University for two more years. The result of four years teaching and at the same time learning, was publication of a text book on "Aptitude Measurement"

completed in January, 1975, and a pamphlet (about 170 pages) on "Children's Psychopathology."

In August, 1975 he came to the University of Florida in Gainesville, to get his doctorate in educational psychology with a minor in psychology. His major interest has been on aptitude x treatment interaction and he worked in this area of research with Professor Mary Lou Koran who has done a great deal of research in this area.

He is a member of APA, and Iranian Psychological Association, also he is a member of Kappa Delta Pi, an Honorary Society in Education, and Pi Lambda Theta, National Honor and Professional Association in Education He has served for one year as the president of international students in education.

He is married and his wife, Ingalil, is from Sweden and they have a son named Reza.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Mary Lou Koran, Chairperson
Professor of Education

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Barry J. Guinag
Associate Professor of Education

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Franz R. Epting
Professor of Psychology

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Robert S. Soar
Professor of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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